

# **STATEMENT REPORT**

## **Of the competition for the academic position “Professor”**

**In the Scientific field: 4. Natural Sciences, Mathematics and Informatics**

**Professional field: 4.6. Informatics and Computer Sciences**

**Scientific specialty: Computer modeling through CAD systems with application in mechatronics and robotics,**

**For the needs of the Sofia University “St. Kliment Ohridski”, Faculty of Mathematics and Informatics (FMI-SU),**

**Competition announced in State Gazette no.20 / 08.03.2024 and on the websites of FMI and Sofia University**

This statement report has been prepared by prof. Dr. Zlatinka Svetoslavova Kovacheva, Institute of Mathematics and Informatics of Bulgarian Academy of Sciences, as a member of the scientific jury of the competition according to Order No. RD-38-203 / 30.04.2024 of the Rector of the Sofia University “St. Kliment Ohridski”.

The documents of only one candidate: Assoc. Prof. Dr. Ivan Nikolov Chavdarov, Department of "Mechatronics, Robotics and Mechanics", Sofia University “St. Kliment Ohridski”, Faculty of Mathematics and Informatics (FMI-SU), were submitted in time for participation in the announced competition.

### **I. General description of the submitted documents**

#### **1. Details of the application**

The documents submitted by the candidate Assoc. Prof. Dr. Ivan Nikolov Chavdarov in accordance with the competition comply with the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Rules for Implementation of the ADAS in the Republic of Bulgaria (RIADAS in the RB) and the Rules on the Terms and Requirements for Acquisition of Scientific Degrees and Occupation of Academic Positions at Sofia University.

For participation in the competition the candidate Assoc. Prof. Dr. Ivan Nikolov Chavdarov presented a list of total 16 titles, incl. 14 publications in Bulgarian and foreign scientific editions and scientific forums, and 2 patents. Evidence of indexation in Web of Science and Scopus and corresponding quartiles is provided for all publications. There are presented, also, 3 copies of diplomas, and other documents (in the form of official notes and certificates from the employer, project manager, awards and other relevant evidence) supporting the candidate's achievements.

Documents are organized and presented in a way that is easy to review and evaluate.

## **2. Short CV of the applicant**

Associate Professor Ivan Chavdarov graduated from the Technical University of Sofia as a mechanical engineer in 1991. In 1992-1993, he acquired a postgraduate specialization in Robotics at the same university. He has many years of professional experience in the Central Laboratory of Mechatronics and Instrumentation - BAS, Institute of System Engineering and Robotics - BAS and Sofia University "Kliment Ohridski", FMI, Department of Mechatronics, Robotics and Mechanics, where he currently works. He is a member of the Bulgarian Robotics Society. He is the recipient of awards and diplomas from the Bulgarian Chamber of Commerce, the Union of Bulgarian Business and the Union of Inventors in Bulgaria, for his active work in the development of robots with practical applications.

## **3. General characteristics of the applicant's scientific work and achievements**

The 14 scientific publications and two patents presented for the competition fall into the following main areas:

- Informatics and computer modeling through CAD systems of mobile robots (Research, control planning and modeling of a novel walking robot based on minimalist principle). Articles numbered 1 to 5, 8.
- Informatics and computer modeling of stationary robots (New methods and kinematics algorithms for stationary robots with consideration of joint constraints, types of solutions to the inverse kinematics problem and presence of obstacles in work area). Articles numbered 11, 12, 13 and 14.
- Applications of informatics and computer modeling in mechatronics and medicine (CAD modeling of: 3D printed robotic humanoid arm; robotic bone drilling). Articles numbered 7, 9, 10.

I can confidently say that:

a) the scientific works exceed the minimum national requirements (under Art. 2b, para. 2 and 3 of ADASRB\*) and respectively the additional requirements of Sofia University 'St. Kliment Ohridski' for holding the academic position of /"Professor" in the scientific field and professional field of the competition;

b) the scientific papers submitted by the candidate do not repeat those of previous procedures for acquiring a scientific title and academic position;

c) there is no legally proven plagiarism in the scientific papers submitted at the competition.

## **4. Characteristics and evaluation of the candidate`s teaching experience**

Ivan Chavdarov has been appointed as an associate professor in the Department of Mechatronics, Robotics and Mechanics (MRM) of the Faculty of Mathematics and Informatics (FMI) of Sofia University "St. Kliment Ohridski" in 2017 and lectures on 8 courses for bachelors and masters in the faculty. A link to lecture notes for students, which are provided in FMI's Moodle

electronic environment, is presented. He conducted training for foreign students under the Erasmus program who visited the FMI of the SU on the basis of bilateral agreements.

Assoc. prof. Ivan Chavdarov supervised the master's theses of five graduates who successfully defended their degrees. He also supervised two successfully defended doctoral students. He is currently the supervisor of two part-time PhD students.

#### **5. Detailed analysis of the scientific and applied achievements of the candidate contained in the materials submitted for participation in the competition**

The following main scientific contributions of the candidate are outlined:

- Creation of a method for optimizing the main dimensions of a walking robot, in order to reduce energy losses when moving on flat terrain and overcoming higher obstacles. A normed space has been introduced for the main dimensions of the robot, which significantly affect its movement and overcoming obstacles.
- Creation of new methods and models for controlling the gait of a walking robot based on the sensory information combined with its movements. A walking cycle optimization model and control algorithms for a walking robot were created.
- Establishing a new method for solving the inverse kinematics problem for open-structure robots by dividing the solutions into types.
- Creation of methods and algorithms for robot movement in an environment with obstacles at accounting for joint constraints and different types of solutions to the inverse kinematics problem.

The main scientific and applied contributions in the presented materials can be summarized as follows:

- A walking robot prototype based on a minimalist principle was designed and built.
- Experimental validation of the method for optimizing the basic dimensions of a walking robot.
- Creation of algorithms and conducting experiments to control the movements of a walking robot with the aim of reducing shock loads when moving on flat terrain and researching irregularities.
- A program working in a CAD environment was created to solve the inverse problem of the kinematics for a redundant robot.

The applicant has submitted 9 publications with an impact factor in Web of Science for participation in the competition. The number of publications falling into the respective quartiles of Web of Science and Scopus are presented in the following table:

Quartile	Web of Science	Scopus
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Q1		3
Q2	2	4
Q3		3
Q4	5	4
Total	7	14

## 6. Critical notes and recommendations

I have no questions and critical notes to the applicant. I wish him to continue to work actively and effectively.

## 7. Personal impression of the applicant

My impressions of the applicant's work and achievements are excellent and they are based only on the documents and evidences submitted for participation in the competition, as I do not know him personally.

## 8. Conclusion on the application

Having become acquainted with the documents and scientific papers presented in the competition and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, I **confirm** that the scientific achievements meet the requirements of the ADAS in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules of the Sofia University "St. Kliment Ohridski" (FMI-SU) for the occupation by the candidate of the academic position "Professor" in the scientific field and professional field of the competition. In particular, the applicant meets the minimal national requirements in the professional field and no plagiarism has been detected in the scientific papers submitted for the competition. I **give my positive** opinion to the application.

## II. GENERAL CONCLUSION

On the basis of the above said, I **strongly recommend** to the Scientific Jury of the competition to propose to the competent body of choice of the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski" to select Assoc. Prof. Ivan Nikolov Chavdarov, for the academic position "Professor" in the Professional field: 4.6. Informatics and Computer Sciences, Scientific specialty: Computer modeling through CAD systems with application in mechatronics and robotics.

20.06.2024

Signature: .....

/ Prof. Dr. Zlatinka Kovacheva/