REVIEW

in a competition for academic position
"Professor"
in the professional direction 4.6 Informatics and Computer Science
(Computer modeling through CAD systems with application in mechatronics and robotics),
for the needs of Sofia University "St. Kliment Ohridski" (SU),
Faculty of Mathematics and Informatics (FMI),
announced in the State Gazette issue No. 20 from 08.03.2024
and on the Internet sites of FMI and SU

The review is prepared by: Prof. Dr. Evgeniy Hristov Krastev from FMI, SU, as a member of the scientific jury for the competition in professional direction (PD) professional direction 4.6 Informatics and Computer Science (Computer modeling through CAD systems with application in mechatronics and robotics) , according to Order No RD-38-205/08.05.2024 of the Rector of Sofia University "St. Kliment Ohridski".

Only one candidate has submitted documents and is accepted for participation in the announced competition, **Associate Professor Dr. Ivan Nikolov Chavdarov, from the Department of Mechatronics, Robotics and Mechanics at FMI, SU.**

I. GENERAL DESCRIPTION OF THE PRESENTED MATERIALS

1. Information about the application

The documents of the applicant comply with the requirements of the Act of the Development of the Academic Personnel of the Republic of Bulgaria (ZRASRB), the Rules for the Implementation of the Act of the Development of the Academic Personnel of the Republic of Bulgaria (PPZRASRB) and the Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at SU (PURNSZATSU).

For participation in the competition, the candidate, Ivan Nikolov Chavdarov (ORCID ID: 0000-0002-3978-4821, ORCID ID: 0000-0002-9975-1255, Scopus H-index: 6), has provided a list of a total of 16 titles, including 12 articles in renowned and specialized foreign scientific journals, 2 protected patents (Patent No. 67070 B1, Patent No. 66752) and 2 publications in collections of reports at scientific conferences. All documents resulting from the requirements of Art. 117 of PURPNSZADSU and proving the fulfillment of the requirements under Art. Art. 115, para. 1, item 2 of PURPNSZADSU. All the applicant's documents are filled out correctly and contain detailed evidentiary material to satisfy the legally established requirements.

2. Information about the candidate

The candidate's CV highlights extensive professional experience in the field of applied mechanics and robotics, which dates back to 1995 when he entered the Central Laboratory of Mechatronics and Instrumentation of the Bulgarian Academy of Sciences (BAS). During 1995 and 2006, he has been research assistant in BAS , MIMS section in Sofia. In 1997, he completed a course in AutoCAD-3D at the Bulgarian-German Educational Center. Possesses professional skills in working with CAD systems (SOLIDWORKS, AutoCAD, etc.), which are essential for the purposes of computer modeling of mechanical systems and individual details in robotics. In 2006 he has received a PhD diploma in the scientific area "Robots and Manipulators". In 2011 he has been appointed as Associate professor at the REMIS section of the Institute of Systems Engineering and Robotics of the BAS, where in 2015 he is elected the Institute's Scientific Secretary.

Since 2017, he holds the academic position of "Associate Professor" at FMI, SU.

The candidate is the author of over 90 publications, holds 8 protected patents and 1 patent application from 2023, all with applications in the fields of mechatronics and robotics. He participated as a leader or executor in over 14 scientific projects (national and international) in the field of robotics. In the period 2020-2023, he reviewed 13 articles submitted for publication in the journals published by MDPI in the scientific fields "Machines, Biomimetics, Robotics, Micromachines, Actuators, Applied Sciences, Sensors, Education Sciences, Mathematics". He has also reviewed works for Wiley's Journal of Field Robotics. The candidate is the winner of a number of prestigious awards such as a Silver badge and diploma for "Dosing casting robot-FEEDMAT 2" (2004), Diploma and gold plaque, winner in the category INVENTIONS*TRANSFER*INNOVATIONS- Union of Inventors in Bulgaria (2016) and Diploma and golden statuette for Inventor of 2017 from the Union of the Inventors in Bulgaria. He organized two exhibitions in Sofia Tech Park (National-Robotics Strategy Forum 2020 and International-Additive Days in Sofia 2018, Days of 3D printing).Associate Professor Ivan Chavdarov is a member of the Bulgarian Robotics Society.

Between 2004-2015 he is a part-time lecturer at the Technical University-Sofia, and since 2017 he is full-time lecturer at FMI.

3. General characteristics of the scientific work and achievements of the candidate

The candidate's professional interests are briefly and clearly stated in his CV. All scientific works and achievements of the candidate without exception are in the field of these professional interests, namely, robotics and mechatronics, design and programming in a CAD environment. In my opinion, Prof. Ivan Chavdarov is among the few of the new generation of scientists in Bulgaria, whose scientific research work has made significant contributions entirely in the field of robotics and mechatronics. The long list of all publications and protected patents of the applicant testifies to high scientific productivity and skills in the development of innovative products in this field.

The candidate has submitted a detailed and correctly completed Reference for the fulfillment of the minimum requirements (under Article 2b, Paragraphs 2 and 3 of the RSARB) and, accordingly, of the additional requirements of the SU. The information in the Reference is supported by relevant

evidence, official documents. In connection with the implementation of indicator B.4 of the minimum national requirements for this competition, Associate Professor Ivan Chavdarov has presented five publications, referenced and indexed in world-famous databases with scientific information (Web of science and Scopus). Four of these publications (1xQ2, 3xQ4) are in specialized scientific journals with a high impact factor [0.343, 3.9] in the field of robotics, and one is a publication in an international conference proceedings with SJR (0.189).The total number of points of the candidate under indicator B.4 is over 198 points and exceeds almost twice the minimum required 100 points in PPZRASRB after applying a corrective factor (3) for PD 4.6 under this indicator.

In connection with the fulfillment of the requirements under indicator Г.7, the candidate has submitted 2 publications in renowned scientific journals (1xQ2, 1xQ4), 7 publications (7xSJR) and 2 patents under indicator D.9, for which a protective document has been issued in due course . The total number of points on these indicators after applying a corrective factor (3) for PD 4.6 is 356 points, which significantly exceeds the required minimum of 200 points. This allows us to claim that the results of the scientific research work of Prof. Ivan Chavdarov are evaluated and reflected in the works of a number of other authors, thereby contributing to the development of robotics and mechatronics.

After checking in major databases with scientific information (Web of Science and/or Scopus), I found that the points for indicator Д for the citations of the works of the candidate are 200 points (after applying a correction coefficient (4) for PD 4.6 in connection with indicator D of PPZRASRB). These points significantly exceed the requirements for the minimum number of 100 items for this indicator.

By evaluating the competition materials in relation to indicator E, I found the following. Prof. Ivan Chavdarov reported participation in the implementation of 1 international project (indicator E.15), as well as in 2 national scientific projects as a leader (indicator E.16) and as a participant (indicator E.14) in 1 project (No. BG05M2OP001 -1.002-0023) (Projects-BAS.pdf). During 2018-2022, he participated in five projects (indicator E.14) of the Scientific Research Fund at SU (Projects-SU.pdf). In the Reference for the fulfillment of the minimum requirements, he noted the scientific supervision of two successfully defended doctoral students (indicator E.13) The implementation of all these activities is equivalent to 170 points in the study of indicator E without taking into account the funds attracted by projects led by the candidate. These points significantly exceed the requirements for the minimum number of 100 points according to this indicator, with which the candidate also completely satisfies the additional requirements of the SU under Art. 122 (2) of PURPNSZADSU.

All this allows me to draw the following conclusions about the scientific works and achievements of the candidate:

a) the scientific works meet and significantly exceed both the minimum national requirements (according to Art. 2b, paras. 2 and 3 of ZRASRB) and the additional requirements of SU "St.

Kliment Ohridski" for occupying the academic position of "Professor" in the scientific field and professional direction of the competition;

b) the scientific works presented by the candidate do not repeat those from previous procedures for acquiring a scientific title and academic position;

c) there is no evidence of plagiarism in the scientific works submitted for the competition

4. Characterization and evaluation of the candidate's teaching activity

The candidate has long-term teaching experience. In the period 2004-2015, he was a part-time teacher at the Technical University in Sofia, where he led lectures and exercises on "Robot Design and Robotic Systems", "Robotic Technologies and Systems", "Robotics" and "Synthesis, Kinematics and robot dynamics". Uses his authored "Robot Design Guide" to run these courses.

In his capacity of "Associate Professor" he delivered lectures and exercises at FMI for MSc degree students ("Kinematics", "Robot Modeling with a 3D printer", "Planning of movements in a complex environment", "Designing mechanical components of robots with CAD systems") and students in B.Sc. degree courses ("3D modeling, printing and applications in robotics", "Programming in a CAD environment and applications in robotics"). An formal documents provided by the candidate certifies that he was scientific supervisor to one successfully defended Ph.D. student from FMI and three Ph.D. students at the Institute of Systems Engineering and Robotics at BAS, Additionally, he was scientific supervisor to five successfully defended diploma students from M.Sc. degree programs of FMI.

5. Substantive analysis of the scientific and applied scientific achievements of the candidate contained in the materials for participation in the competition

The research papers and patents presented by Associate Professor Ivan Chavdarov for participation in the competition contain original scientific and scientifically applied contributions in the following thematic areas:

(1) Informatics and computer modeling through CAD systems of mobile robots

(2) Informatics and computer modeling of stationary robots

(3) Applications of informatics and computer modeling in mechatronics and medicine

In these thematic areas, the following scientific contributions of the candidate stand out:

a) An original method was created to optimize the main dimensions of a walking robot in order to reduce energy losses during movement on flat terrain (publications [2-4])

b) A new model and related control algorithms have been developed to optimize the walking cycle of a walking robot (minimizing impact loads and maximizing walking speed at a given motor power) using sensors. (publications [1], [5])

c) An original method for planning the trajectory of a manipulator with additional stages when avoiding obstacles is proposed. (publication [14])

The candidate's scientific contributions are presented in journals with a high impact factor [0.39- 3.9] and have more than 62 citations to date indexed in Web of Science/SCOPUS. In most of

these publications, Associate Professor Ivan Chavdarov is the lead author. In collective works, I assume that the contributions are distributed equally among the individual co-authors.

The candidate's publications submitted for participation in the competition contain several significant scientifically applied contributions, among which I accept to highlight the following few:

a)   Designing and creating an original walking robot prototype based on a minimalist principle (publications [2-4] and patent [16])

b)   A 3D printed humanoid robotic arm was created with an original design built on a modular principle (publications [9-10] and patent [15]).

c)   A new algorithm for determining the main kinematic characteristics of a finger of a humanoid hand was proposed and developed (publications [6-7] and [9])

The candidate's scientifically applied contributions allow the development of concrete applications of socially significant value. A large part of these contributions are protected by two of his patents ([15-16]), which confirms the original contribution and significance of the achieved results.

It makes an excellent impression that the candidate links his achievements in these areas with his project work on four scientific projects cited in his Author Reference (14.Contributions.pdf)

The candidate's scientific and applied scientific achievements demonstrate the applicant's deep knowledge in the field of robotics, combined with skills in using CAD systems and realization of 3D printed robot models with application in mechatronics and robotics.

6. Critical notes and recommendations

I have no critical comments on the submitted materials for participation in the competition.

7. Personal impressions of the candidate

I have known Associate Professor Ivan Chavdarov since he joined FMI-SU more than five years ago, and I have immediate impressions of his teaching and applied research activities in the Department of Mechatronics, Robotics and Mechanics. This allows me feel confident stating that he is a scientist with extensive knowledge and expertise in the field of robotics and in particular, computer modeling and development of original applications with real end-user value in this subject area. Associate Professor Ivan Chavdarov is distinguished by his exceptional modesty and working capacity that at the same time are combined with responsibility, collegiality and skills for teaching in a team as well as conducting joint scientific research with younger members of the department. He has substantial credit for the department's successes.

8. Conclusion on the application

After having familiarized myself with the materials and scientific works presented in the competition and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, I confirm that the scientific achievements meet the requirements of Act of the Development of the Academic Personnel of the Republic of Bulgaria, the Regulations for its application and the relevant Regulations of SU "St. Kliment Ohridski" for the candidate to occupy the academic position of "Professor" in the scientific field and professional direction of the

competition. The scientific and scientific applied activities as well as the educational activities of the candidate fall entirely in the scope of the professional direction of the competition. The candidate **satisfies and significantly overwhelms each one of the minimum national requirements in the professional direction.** No evidence for plagiarism has been found in the scientific works submitted for the competition.

I give my **positive** assessment to the application.

II. OVERALL CONCLUSION

Based on the above, I **strongly recommend** the scientific jury to vote positively on a proposal to the to the competent authority at the Faculty of Mathematics and Informatics of Sofia University "St. Kliment Ohridski" **to elect, Associate Professor Dr. Ivan Nikolov Chavdarov, for the academic position of "Professor"** in professional direction 4.6 Informatics and Computer Science (Computer modeling through CAD systems with application in mechatronics and robotics).

June 22nd, 2024.   Review prepared by: ....

Professor Evgeniy Hristov Krastev, PhD