Review

in the competition for academic position

"Associate Professor"

in the professional field 4.6 "Informatics and and computer science" (Software and hardware implementation of manipulator motion control algorithms)

for the needs of Sofia University "St. Kliment Ohridski"(SU)

Faculty of Mathematics and Informatics (FMI)

announced in State Gazette issue 61 of 02.08.2022 and on the Internet page of FMI of SU

The review was prepared by: Prof. PhD Stefka Stoyanova Fidanova, IICT-BAS, professional field 4.6 "Informatics and and computer science", as a member of the Scientific Jury of the competition according to order № 38-562/ 28.09.2022 of the Rector of Sofia University.

One candidate has submitted documents for participation in the announced competition:

Assist. Prof. Kaloyan Yovchev - SU "St. Kliment Ohridski"

I. General description of the materials presented

1. Data of the candidature

The submitted documents from the applicant meet the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB) and The Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at Sofia University “St. Kliment Ohridski ".

The candidate Kaloyan Yovchev has submitted a list of 14 titles for the competition. 14 publications in Bulgarian and foreign scientific publications and scientific forums, 0 studios, 0 monographs, 0 books, 0 certificates and patents, 0 textbooks and teaching aids. 5 other documents (in the form of job descriptions and certificates from an employer, project manager, project sponsor or sponsor, references and reviews, awards and other relevant evidence) supporting the applicant's achievements were also presented.

Notes and comments on the documents.

As a member of the scientific jury, I have received all the documents attached to the application to the Rector of SU "St. Kliment Ohridski" of the only candidate in the competition ch. Assistant Professor Kaloyan Marianov Yovchev, Ph.D.

2. Data of the candidate

Kaloyan Yovchev obtained a Master's degree in Informatics, specialty in "Mechatronics and Robotics" at the Faculty of Mathematics and Informatics of Sofia University, St. Kliment Ohridski" in 2015. He obtained an educational and scientific degree Doctor in scientific specialty 4.6 Informatics and computer sciences (Information technologies) from the Faculty of Mathematics and Informatics of Sofia University "St. Kliment Ohridski" in 2018 based on a defended dissertation on the topic "Iterative self-learning for manipulative robot control" (diploma No SU 2018-145). Since 2019, he has been working as an assistant professor in the Department of "Mechatronics, Robotics and Mechanics" of the Faculty of Mathematics and Informatics of Sofia University "St. Kliment Ohridski".

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

According to Law on the Development of Academic Staff in the Republic of Bulgaria, the rules for its implementation and the specific requirements introduced in the regulations of Sofia University, applicants must meet the following requirements:

1. Have acquired a doctorate degree in education and science;
2. Have held the academic position of "Associate Professor" at the same or another higher education institution or scientific organization for at least two academic years;
3. Have submitted published monographs or equivalent publications in specialized scientific editions which do not repeat the ones submitted for the degree of PhD, the Doctor of Sciences and the academic position of Associate Professor;
4. Have submitted other original research papers, publications, inventions and other scientific and applied research works which are evaluated in aggregate;
5. Meet the national minimum requirements;
6. Not to have the lawful plagiarism proven in scientific works.

For indicators from group B requirements, Kaloyan Yovchev submitted 4 publications, 3 of them have impact factor, respectively 2 in Q2 and one in Q2 and one paper is with impact rank. **.** The total number of points is 138 for the required 100.

For indicators from group Г, a total of 10 publications are presented, 8 of which have an impact rank, and the rest are in publications referenced in the world peer-review and indexing system. The total number of points is 276 out of 200 required.

Assistant Professor Kaloyan Yordanov has submitted 8 citations to his publications. These citations are visible in Scopus. The total number of points is 64 out of the required 50 for indicator D.

a) the scientific works comply with the minimum national requirements (under Art. 2b, para 2 and 3 of LDASRB) and respectively with the additional requirements of Sofia University “St. Kliment Ohridski "for the academic position of Associate Professor in the scientific field and professional direction of the competition;
b) the scientific papers submitted by the applicant do not repeat those of previous procedures for the acquisition of a scientific title and occupation of an academic position;
c) there is no proven plagiarism in the scientific works presented at the competition.

Kaloyan Yordanov fulfills and even exceeds the requirements for holding the academic position of associate professor.

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

Kaloyan Yordanov had a total of 1,784 hours of study, of which 1,067 were classroom hours for the period 2019-2022. There is no information in the documents about the supervision of graduates.

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

The main contributions in the candidate's research activity can be systematized as follows:

1. Scientific contributions

A new control method with iterative self-learning (Iterative Learning Control, ILC) with constrained output (Constrained Output ILC, COILC) has been developed. COILC solves both the problems of the presence of constraints in the state space and the presence of transient error, which are the main obstacles to the application of ILC to nonlinear constrained systems. COILC can be applied in the control of systems with limited output state space (eg manipulators). The convergence of the method is proven.

2. Scientific and applied contributions

- A computer simulation of manipulative robots was created, through which the proposed control methods with iterative self-learning of robots were experimentally verified.
- An approach for implementing iterative self-learning control in the presence of obstacles in the workspace of manipulative robots is proposed.
- An approach is presented by which the gripper of a manipulative robot can be precisely

positioned to a desired object. The approach combines computer vision and control with iterative self-learning. It is applicable when there is very little knowledge about the mathematical model of the robot.

- An intelligent remote control and communication system for service robots has been developed. The system is based on the Internet of Things, Web technologies, Wi-Fi and the ROS operating system. The structure of the system and the applied technologies used to develop the system are described. The system is implemented in practice and its capabilities are presented.
- A cost-effective hardware and software design is proposed for the control of anthropomorphic and additional degrees of freedom robots that perform point-to-point or trajectory motions.
- The zero-moment method was investigated and evaluated by computer simulation of forward motion performed by a bipedal robot with 10 degrees of freedom.

3. Applied Contributions

- Educational anthropomorphic and cost-oriented mobile service robots have been developed.
- Software provisioning with a web-based user interface for the designed robots has been implemented.
- The usability of remotely controlled service robots has been investigated by performing real experiments with the robots and elderly people, and the control of the robots is based on a multi-channel system for distributing data from external devices, such as - joystick, virtual joystick, microphone, etc.
- A MATLAB computer simulation of quadcopter control was developed to track the deviation from the desired flight path in turbulence conditions.

The candidate's publications are in the fields of robotics, robot control, and human-robot interaction. A method for controlling robots with iterative self-learning has been developed. Intelligent methods for controlling service robots as well as a remote control system are proposed. Some of the developments are aimed at helping the elderly and people with disabilities to improve the quality of their lives. These robots can help with daily life tasks, such as reminders to take medications, serving food and drinks, controlling household appliances, and even monitoring health status. Apart from the direct communication of the user with the robot, there is also the possibility of remote monitoring and control. The balance between functionality and cost of the robot has been studied, aiming for maximum efficiency and accessibility for the user at the same time. The influence of atmospheric turbulence on unmanned aerial vehicles has been investigated. The

deviation from the desired trajectory was evaluated.

It is noteworthy that the candidate's developments have a direct application in practice.

All publications are co-authored. The field in which Kaloyan Yordanov is developing is multidisciplinary and it is normal to work in a team. I know some of its co-authors and I think that the candidate's contributions are substantial.

6. Critical notes and recommendations

I have no remarks on the scientific works of the candidate. My only critical note is the lack of a detailed description of his teaching activities and the courses he leads.

7. Personal impressions of the applicant

I do not know the candidate and I have no personal impressions of him.

8. Conclusion on the application

After learning about the materials and scientific works 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 LDASRB. The Regulations for its implementation and the corresponding Regulations of Sofia University “St. Kliment Ohridski "for the position of the candidate in the academic position of Assoc. Professor in the scientific field and professional direction of the competition. In particular, the applicant meets the minimum national requirements in the professional field and no plagiarism has been detected in the scientific papers submitted at the competition.

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

II. Overall Conclusion

On the basis of the above, I recommend that the scientific jury propose to the competent body of choice of the Faculty of Mathematics and Informatics at Sofia University “St. Kliment Ohridski "to choose Kaloyan Yovchev to take the academic position of Associate Professor in the professional field 4.6 "Informatics and and computer science".

28.10.2022 Written by:

(Prof. Stefka Fidanova)