

**OPINION**  
**by competition for an academic position**  
**"Associate Professor"**  
**in professional direction 4.5 Mathematics (Mathematical modeling and**  
**applications in robotics and mechatronics),**  
**for the needs of Sofia University "St. Kliment Ohridski" (SU),**  
**Faculty of Mathematics and Informatics (FMI),**  
**announced in State Gazette no. 20 of 08.03.2024 and on the FMI and SU**  
**websites**

**From:** Prof. Dr. Emil Samuil Manoch from the Institute of Mechanics – Bulgarian Academy of Sciences, member of the scientific jury for the competition according to Order No. RD-38-204/ 04/30/2024 of the Rector of Sofia University.

To participate in the announced competition, the only candidate submitted his documents Assistant Professor Dimitar Trajko Nedanovski, PhD, from the Faculty of Mathematics and Informatics of Sofia University "St. Kliment Ohridski".

**I. General description of the presented materials**

To participate in the competition, the candidate Associate Professor Dimitar Trajko Nedanovski, Ph.D., has presented 9 papers published in scientific journals, all 9 of which are in publications with an impact factor or SJR. Seven of the publications with which the candidate participated in the competition were in journals. The total number of publications per candidate is 14: 9 publications in scientific journals, 3 publications in refereed proceedings of international conferences and 2 preprints.

The candidate's works have been cited 31 times.

**2. Applicant data**

D-r Dimitar Trajko Nedanovski, assistant professor, studies at the Faculty of Physics of the University of St. Kliment Ohridski" and in 2007 became "Bachelor of Physics" (2007)

After that, he completed his master's degree at the Faculty of Mathematics and Informatics and became a "Master of Mathematics" (2009).

In 2016, he defended his dissertation professional direction 4.1 "Physical Sciences" (theoretical and mathematical physics), obtaining the scientific and educational degree "Doctor", at the

Institute for Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences.  
Dissertation topic: "Superconformal vertex algebras in four-dimensional space-time".

From 2008 to 2009, the candidate worked as a part-time teacher at the "St. Kliment Ohridski", Faculty of Mathematics and Informatics, Department of "Algebra". From 2014 to 2015 he was a researcher - Sciex at the University of Geneva, Department of Mathematics, and from 2009 he worked as a physicist at the Institute for Nuclear Research and Nuclear Energy, BAS. Since 2017, Dr. Nedanovski has been working at the FMI of SU "St. Kliment Ohridski", and during the period 2017-2019 he held the position of "assistant in mathematics", and from 2019 until now he is the "main assistant" in the FMU Department of "Mechatronics, Robotics and Mechanics".

### 3. General characteristics of the scientific works and achievements of the candidate

Dr. Nedanovski's papers show that he works mostly in the fields of mathematical modelling, mechanics and robot control. There is one publication dealing with in quantum field theory. Mathematical modeling includes that of real technological processes, as well as their optimization.

The scientific works meet the minimum national requirements (under Article 2b, Paragraphs 2 and 3 of the RSARB) and, accordingly, the additional requirements of SU "St. Kliment Ohridski" for occupying the academic position of "associate professor" in the scientific field and professional direction of the competition. They fully cover and exceed the minimum national requirements (for "associate professor"), as for group B the presented articles give 120 points with a requirement - 100 points, for group D - 270 points with a requirement - 200 points, and for group D – 248 items, if required – 50 items.

The scientific works presented by the candidate do not repeat those from previous procedures for acquiring a scientific title and academic position, and no plagiarism has been proven according to the law.

### **4. Characteristics and assessment of the candidate's teaching activity**

I judge the educational and pedagogical activity of the candidate from the reference submitted by the candidate. She significant teaching activity:

- Lectures – a total of 14 semesters (12 - Applied Mathematics 2, specialty Computer Engineering, specialty Communications and Physical Electronics, Faculty of Physics of SU; 2 - Applied Mathematics 4, specialty Communications and Physical Electronics, Faculty of Physics of SU),

- Exercises - a total of 28 semesters (4 - Analytical Mechanics, specialty Applied Mathematics, Faculty of Mathematics and Informatics of SU; 14 - Mathematics, specialty Molecular Biology, Faculty of Biology of SU; 10 - Applied Mathematics 3, specialty Computer Engineering, specialty Communications and physical electronics, Faculty of Physics of SU).

### **5. Content analysis of the applicant's scientific and applied scientific achievements contained in the materials for participation in the competition**

In the report on scientific contributions, the candidate tentatively divided his works into three groups:

**(A) Mathematical Modeling and Optimization in Oil Refinery Processes - Publications 1, 3, 4, 5, 6.**

**(B) Mechanics and Control of a Walking Robot - Publications 2, 8, 9.**

**(C) Renormalizations in Quantum Field Theory - Publication 7.**

**The first group** contains works in which functions are sought to model dependencies of certain technological quantities in oil refining processes.

Non-linear regression analysis was applied to determine the extreme (minimization) values of the parameters. The sensitivity of the decisions to the data and to the parameters of the processes was also investigated, and an optimization of their number was also carried out. For each of the studied cases, the Akaike information criterion (AIC) or the Bayes information criterion (BIC) was calculated and offered the model with the lowest AIC and BIC value. It is shown that the proposed approaches sufficiently approximate the real processes and phenomena occurring in the processing of oil and oil derivatives.

Works in this group demonstrate the candidate's capabilities in the field of mathematical modelling. A certificate of the quality of the works is that they have been published in many authoritative scientific journals, such as Fuel.

**In the second group** of works are grouped works concerning a walking robot based on a minimalistic design (there are only two degrees of freedom). Despite the relatively simple construction, the robot is capable of walking back and forth by turning at an arbitrary angle, bypassing obstacles, and climbing stairs. A dynamic model of the robot is proposed, and based on this model, a torque control law of the motor that drives the stepping mechanism.

Algorithms for controlling the robot's motion are also presented, which improve the gait cycle by reducing shock loads and provide a smooth transition between the two phases of the robot's motion. Algorithms also allow increasing walking speed. The 3D printed prototype of the robot was created, to which various types of sensors are included. Two laws of motion - sinusoidal

and polynomial - were investigated, and the results were compared with those of robot motion with constant angular velocity. Experimental results confirm the proposed laws of motion.

In the third group there is only one publication - publication 7. The contributions here concern a recursive analytic renormalization procedure in coordinate space for massless quantum fields. The ninth publications presented for the competition were cited 31 times in scientific works referenced in SCOPUS.

#### **6. Critical notes and recommendations**

I have no critical remarks about the candidate.

#### **7. Personal impressions of the candidate**

I have no personal impressions. I don't know the candidate.

#### **8. Conclusion on the application**

Analyzing the materials and scientific works presented in the competition and evaluating the significance of the publications presented and the scientific and scientific-applied contributions contained in them, I am convinced that the scientific achievements of Dr. Nedanovski meet the requirements of the ZRASRB, the Regulations for its application and the relevant Regulations of SU "St. Kliment Ohridski" for the candidate to occupy the academic position of "associate professor" in the scientific field and professional direction of the competition.

### **II. GENERAL CONCLUSION**

Based on the above, I strongly recommend the scientific jury to propose to the competent selection authority, the Faculty of Mathematics and Informatics at SU "St. Kliment Ohridski", to choose Ch. assistant professor, Dr. Dimitar Trajko Nedanovski, to take the academic position of "associate professor" in professional direction 4.5 Mathematics (Mathematical modelling and applications in robotics and mechatronics).

26.06.2024.

Prepared the opinion: .....

(Prof. Dr. Emil Manoach)