REVIEW

on the competition for the academic position of "Associate Professor"

in professional field 4.5 MATHEMATICS (scientific specialty MATHEMATICAL MODELING AND APPLICATIONS IN ROBOTICS AND MECHATRONICS)

at Sofia University "St. Kliment Ohridski" (SU),

Faculty of Mathematics and Informatics (FMI),

announced in the State Gazette no. 20 of 08/03/2024 and on the FMI and SU websites

This review is prepared by Prof. Ludmil Kirilov Hadjiivanov, D.Sc. (INRNE-BAS), professional field 4.1 Physical Sciences (scientific specialty Theoretical and Mathematical Physics), as a member of the scientific jury for the competition according to Order No. RD-38-204/30.04.2024. of the Rector of Sofia University.

Only one candidate has submitted documents for participation in the competition: **Dr. Dimitar Trajko Nedanovski**, Ch. Assistant Professor at the Department of Mechanics, Robotics and Mechatronics, Faculty of Mathematics and Informatics, Sofia University "St. Kliment Ohridski".

I.   General description of the submitted documents

1. Applicant data

The documents submitted by the candidate for the competition correspond to the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its Application and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski".

For his participation in the competition, the candidate Ch. Assistant Professor Dr. Dimitar Trajko Nedanovski, submitted (copies of) the following documents:

- Curriculum Vitae (CV),

- Higher education diploma – Master of Mathematics (FMI, 2009),

- Diploma for Doctor of Theoretical and Mathematical Physics (INRNE-BAS, 2016),

- Document for a scientific title or academic position - Agreement for an employment contract for the position of Chief Assistant Professor at FMI-SU, Department of "Mechatronics,

Robotics and Mechanics", effective from 06.06.2019 (addendum to the Agreement from 2017 for the position of Assistant),

- Certificate of work experience (in the position of Assistant and Chief Assistant Professor), issued by the "Human Resources" Department of SU on 16.04.2024,

- Reference for general academic and classroom employment (by academic years and semesters) for the last seven academic years from 2017/2018 until now, prepared by the Academic Department and certified with the signature of the Dean of FMI-SU,

- List of all publications,

- List of publications submitted for the contest,

- List of publications, conferences, projects and scientific guides, generated by the "Authors" system (for the period in which the candidate already holds an academic position at SU "St. Kliment Ohridski"),

- Sample reference for the fulfillment of the minimum national requirements and the additional requirements of SU "St. Kliment Ohridski",

- List of independent citations with full bibliographic description of cited and citing publications (31 citations confirmed by Scopus),

- List of the original scientific contributions,

- Copies of all scientific works submitted for participation in the competition,

- Summaries of the peer-reviewed publications by list (in Bulgarian and in English),

- Copy of the announcement of the competition in the State Gazette (SG No. 20 / 08/03/2024).

The candidate's achievements in the field of Mathematical modeling and optimization in oil refining processes are confirmed in a review signed by Prof. Dr. Svetoslav Nenov, Deputy Rector of HTMU, in which the five publications in the relevant field with which Ch. Assistant Professor Dimitar Nedanovski participated in the competition as well the possibilities for their application to optimize processes in Lukoil Neftochim Burgas are highlighted.

In conclusion, the documents submitted by the applicant for participation in the competition provide reliable and comprehensive information on all issues provided for the purpose in the Act for the Development of the Academic Staff in the Republic of Bulgaria and the two relevant Regulations.

2. Biographical and professional data for the candidate

The only candidate in the competition Dr. Dimitar Trajko Nedanovski, Ch. Assistant Professor, is 40 years old. He received his higher education at the Sofia University "St. Kliment Ohridski", obtaining the degrees of BSc in Physics at the Faculty of Physics in 2007 and MSc in

Mathematics at the Faculty of Mathematics and Informatics in 2009 (under the Master's program "Mathematics and Mathematical Physics", thesis title "Renormalization Theory in configuration space", with an average GPA from the exams and from the defense "excellent 6.00").

In 2016, he defended the educational and scientific degree Doctor in the scientific specialty 4.1 "Physical Sciences" (Theoretical and Mathematical Physics) at the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences, the title of his dissertation being "Superconformal vertex algebras in four-dimensional space-time'.

Dimitar Nedanovski began his working biography as a part-time lecturer at the "Algebra" department of FMI-SU (2008-2009). In 2009, he was appointed to the position of Physicist (which he also currently holds) at the "Theory of Elementary Particles" Laboratory of the INRNE-BAS. During the years 2014-2015 he was a researcher at the Department of Mathematics of the University of Geneva. In 2017, the applicant was appointed to the Department of "Mechanics, Robotics and Mechatronics" at the Faculty of Mathematics and Informatics of SU "St. Kliment Ohridski", where he has been until now holding at first an Assistant Professor position and from 2019, as a Chief Assistant Professor.

2. General characteristics of the scientific works and achievements of the candidate

The candidate Ch. Assistant Professor Dr. Dimitar Trajko Nedanovski has presented the list of all his 14 publications, including 9 publications in Bulgarian and foreign scientific publications, 3 in proceedings of scientific conferences (of which for participation in the current competition, respectively 7 and 2), as well as 2 preprints in the electronic archive. The nine publications with which Ch. Assistant Professor Dr. Dimitar Nedanovski participated in the competition, (included in the attached file 10B.SelectedPublicationsList.pdf, whose numbering we follow below), are in the following three different groups of topics:

(A) Mathematical modeling and optimization in oil refining processes - publications [1, 3, 4, 5, 6];

(B) Mechanics and control of a walking robot - publications [2, 8, 9];

(C) Renormalization in Quantum Field Theory (QFT) - publication [7].

The first eight publications in the above list (groups (A) and (B)) are in the field of applied mathematics and the last one, in group (C) (from 2017) is theoretical, in the field of mathematical physics. The papers in group (B) have been published between 2019 and 2023, and those in group (A), between 2021 and 2023.

The survey of the submitted documents allows to form the following general assessment of the candidate's scientific works and results.

a) The indicators of scientific works exceed by far the minimum national requirements under Art. 2b, (2) & (3) of Act for the Development of the Academic Staff in the Republic of Bulgaria and the corresponding additional requirements of SU "St. Kliment Ohridski" to occupy the academic position of "Associate Professor" in the scientific field 4. Natural sciences, mathematics and informatics, professional field 4.5 Mathematics; e.g., in the attached Reference in the group of indicators B there are 120 points when the required threshold is 100 points, in the group of indicators D – 270 points for a minimum of 200, and in the group of indicators D – 248 points for a minimum of 50 points.

b) Neither of the scientific works presented by the candidate has been presented by him in previous procedures for acquiring a scientific title and academic position;

c) No plagiarism has been noticed in the scientific works submitted for the competition.

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

It can be seen from the attached certified reference that after 2017, when he was appointed to FMI-SU "St. Kliment Ohridski", so far the candidate Ch. Assistant Professor Dimitar Nedanovski has lectured on Applied Mathematics 2 and 4 to students from the Computer Engineering and Communications and Physical Electronics majors at the Faculty of Physics of Sofia Univerity "St. Kliment Ohridski" (7 courses in total) and led seminar exercises on Analytical Mechanics to students in Applied mathematics of FMI (2 courses); Mathematics, for the Molecular Biology specialty in the Faculty of Biology (7 courses) and Applied Mathematics 3, in the Computer Engineering and Communications and Physical Electronics specialties, at the Faculty of Physics (5 courses). The corresponding classroom occupancy in these 3 different faculties of the Sofia Univerity "St. Kliment Ohridski" during the last 6 academic years varied from 315 to 540 teaching hours (and similar in the not yet completed current academic year), and its total teaching occupancy has been remarkably high, between 420 and 690 teaching hours.

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

The contributions in the 9 scientific works submitted for the competition coauthored by the candidate can be generally characterized as development and enrichment of the existing

knowledge in the respective fields, and the 8 publications from the first two groups (A) and (B) are also clearly oriented to application of scientific achievements in practice.

The five papers in group (A) Mathematical modeling and optimization in oil refining processes published, respectively, in the journals Fuel (WoS IF 7.2, Q1) – 1 paper, Energies (WoS IF 3.2, Q3; SJR 0.632, Q1) – 3 papers, and Resources (SJR 0.742, Q2) – 1 paper, have been cited altogether 26 times (and two of them, [5] and [1], 11 and 9 times, respectively), which is a very impressive achievement, especially considering the short time since their appearance.

The paper [2] from group (B) Mechanics and control of a walking robot has been published in the journal Sensors (WoS IF 3.9, Q2; SJR 0.79, Q1) and the other two papers on this topic, in refereed proceedings of international conferences (the three are cited 2 times in total). Paper [8] from group (C) Renormalization in QFT (in the Proceedings, or Comptes Rendus of BAS, SJR 0.21, Q2) has been cited once. The total number of independent citations to the candidate's papers is 31 (2 of them of papers related to candidate's PhD thesis which are not submitted to the competition).

Thus, the candidate's results in the field of modeling and optimization of various oil refining processes (theme (A)) play a major role in shaping the evaluation of his work. In brief, the essence of the problem in all of them is to find suitable functions modeling well the interdependencies of certain quantities in the respective process (the details of the individual cases are well described in the enclosed List of the original scientific contributions). An algorithm is used in which one starts with a set of probability distributions or empirical functions depending on certain parameters. By applying the nonlinear regression method, the minimization values of these parameters are found. The sensitivity to the data is analyzed and the minimization of the number of required parameters is sought. For each case, Akaike's Information Criterion (AIC) or Bayesian Information Criterion (BIC) is calculated and the model with the lowest AIC and BIC value is singled out.

The authors claim that no better framework of the type initial data–data–prediction has been described in the literature known to them than those in their derived models. This claim finds solid support in the mentioned very good citability of the cycle of works and also in the review by Prof. Dr. Svetoslav Nenov, deputy rector of HTMU. The importance of the applicant's contribution is also confirmed in the review. Another indirect criterion for this such as the place of his name in the list of authors supports such a conclusion.

The three publications [2, 8, 9] are devoted to the development of an innovative walking robot ("Big Foot", group (B)) with two degrees of freedom, capable of moving back and forth,

turning at any angle, going around obstacles and climbing steps appropriate to his size. In [9] and [8] the candidate has contributed to the study of the kinematics and dynamics of the described robot, and in [2], to the theoretical study of the proposed two (sinusoidal and polynomial) laws of motion.

Work [7] is part of a cycle with the applicant's participation on the analytical renormalization of Feynman amplitudes in the Nikolov-Stora-Todorov (NST) approach, using techniques for the continuation of homogeneous distributions (generalized functions) in coordinate space. A recursive procedure for analytical renormalization of a general Feynman amplitude for massless quantum fields is proposed, based on the so-called causal factorization.

6. Critical notes and recommendations

I have no critical comments on the works presented for the competition regarding the setting of the problems, the analyses made in them, the obtained results and the knowledge of literature of the authors. A few years ago, the candidate could have been criticized for insufficient publication activity, but it has been fully compensated by his active work recently, especially after 2019.

7. Personal impressions of the candidate

I have known Dimitar Nedanovski for twenty years and I appreciate him highly as a person and a scientist. I have collected my impressions as a reviewer in various competitions, as a colleague at INRNE-BAS, as head of contracts with the National Foundation for Scientific Research, from his seminars and talks, from his participation in organizing committees of national and international events, etc. I would say that Dimitar has a very good background in the areas of mathematics and physics in which he works, and a broad general culture and knowledge of history, politics, etc., which are also important. He is diligent, punctual, efficient and ethical in his social contacts, which makes him helpful and welcome both in the working environment and outside it.

8. Conclusion on the application

Getting acquainted with the documents and the scientific works of the applicant presented for the competition and on the base of the analysis of their significance and the scientific and application oriented contributions contained in them, **I confirm** that the scientific achievements meet the requirements of the Act for the Development of the Academic Staff in the Republic

of Bulgaria, the Regulations for its Application and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski" for the candidate to occupy the academic position of "Associate Professor" in the professional field and scientific specialty of the competition. In particular, the applicant satisfies the minimum national requirements in the professional field and no plagiarism has been found in the scientific works submitted for the competition.

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

II. GENERAL CONCLUSION

Based on the above, **I recommend** the scientific jury to propose to the competent authority for the selection at the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski**" to elect Ch. Assistant Professor Dr. Dimitar Trajko Nedanovski** to take the academic position of **"Associate Professor"** in the professional field **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 SG no. 20 of 08/03/2024 and on the FMI and SU websites.

June 28. 2024   Reviewer: ....

                                                            (Prof. DSc Ludmil Hadjiivanov)