REVIEW

on a competition for the occupation of the academic position "professor"in the research area 4.5 Mathematics (Differential equations, Hamiltonian systems), for the needs of Sofia University "St. Kliment Ohridski"(SU), Faculty of Mathematics and Informatics (FMI), announced in DV no. 56 of 30.06.2023 and on the FMI and SU websites

The review was prepared by: Prof. Sevdzhan Ahmedov Hakkeev, DrSci, IMI-BAN, in my capacity as a member of the scientific jury for the competition according to Order No. RD 38-515/29.08.2023. of the Rector of Sofia University.

Only one candidate - Assoc. DrSci Ognyan Borisov Christov, FMI, SU has applied for participation in the competition.

I. General description of the presented materials

1. Application details

To participate in the competition, Associate Professor O. Christov submitted a list of 6 articles published in scientific publications, as well as other documents such as: creative resume, diploma for higher education, diploma for scientific title, diplomas for scientific degrees, list of all publications, author reference, reference for citations, reference for fulfillment of the minimum national requirements of ZRASRB, PPZRASRB and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski"(PURPNSZADSU).

The scientific publications submitted for participation in the competition do not repeat those submitted for the acquisition of the educational and scientific degree PhD, the scientific degree "Doctor of Sciences"and for holding the academic rank "Associate Professor".

2. Applicant data

Ognyan Borisov Christov was born on 27.07.1959 in the town Lom. He graduated in mathematics from FMI, SU in 1984. In 1994, he obtained the PhD degree. In 2017, he defended his thesis for the acquisition of the Doctor of Sciences degree. The teaching experience of Prof. Christov began

in 1986 as an assistant at TU "Angel Kanchev"Ruse. During the period 01.03.1991-12.10.2001, he was successively assistant and senior assistant at FMI of SU. As of 12.10.2001, he is an associate professor at the Department of Differential Equations of the FMI of SU.

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

Christov's research interests are in the area of Differential Equations and Mathematical Physics and in particular Dynamical systems, Integrability and nonintegrability of Hamiltonian systems. For the competition, 6 articles were presented, which were not used for the acquisition of the PhD and "Doctor of Sciences"degrees, as well as for obtaining the academik rank "Associate Professor". All submitted works are independent.

The candidate's articles have been published in the following scientific journals: Advances in Mathematical Physics, Symmetry, Nonlinear Dynamics, Eur. Phys. J. Plus, Discrete and Continuous Dynamical Systems –B. One of the presented articles falls in the Q1 quartile, three of them fall in the Q2 quartile, one falls in the Q3 quartile, and one article is with SJR. The total IF of Prof. Christov's articles submitted for the competition is 13.203. It is clear that the publications presented by the candidate exceed the minimum national requirements (according to Article 2b, Paragraphs 2 and 3 of the RSARB) and, accordingly, the additional requirements of the SU "St. Kliment Ohridski"for occupying the academic position of "professor"in the scientific field and the professional direction of the competition.

O. Christov has presented data for 54 citations of his articles, which do not repeat those presented for the holding of academik rank "Associate Professor"and the receipt of the degree "Doctor of Sciences". The quotes provided are many times over the minimum required. Another recognition of the candidate's high professionalism is his participation as a reviewer in journals such as J.Math.Phys., Bull. Sci. Math., Phys. Lett. A, J.Math. Anal. Appl., Nonlinear Analysis, Nonlinear Dynamics, etc.

Associate Professor Christov has participated in several national projects at the National Institute of Scientific Research - Participant in project MM 1504/2005, Scientific Research Fund - Manager of the following projects: MM 523/1995, "Algebraic-geometric methods in dynamic systems Fund "Scientific research MM 1003/2000, "Algebraic, analytical and topological methods in dynamic systems Fund "Scientific research DDVU 02/90 "Dynamic Systems and Applications Fund "Scientific Research"

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

Prof. Christov's teaching activity is very diverse. He has led lectures and exercises on Mathematical Analysis, Linear Algebra, Ordinary and Partial Differential Equations, Analytical Mechanics. He has been a visiting professor at various Western universities. Prof. Hristov has extensive teaching activities abroad as well. In 2011, he delivered a series of lectures on Dynamic Systems at the University of Tuzla, Bosna and Herzegovina. O. Christov has 11 successfully defended thesis (masters) and one successfully defended doctoral student.

5. Съдържателен анализ на научните и научноприложните постижения на кандидата съдържащи се в материалите за участие в конкурса

I will adopt the numbering of the list of works presented in the competition.

In article [23], the Fischer-Kolmogorov-Petrovsky-Piskunov equation is considered

$$u_t = Du_{xx} + u(1-u)$$

with a small diffusion parameter $D = \epsilon^2$. The perturbed singular boundary value problem is also considered

$$\epsilon^2 u_{xx} + u(1-u) = 0$$

$$u(0) = a, \;\; u(1) = a, \;\; a \in (0,1).$$

. Asymptotic formulas for the solutions of the singular boundary value problem have been obtained. The number of solutions of the singular boundary value problem and the number of solutions that lie below the line $u = a$ were investigated.

Article [35] is devoted to the investigation of the integrability of periodic Klein-Gordon latices in low dimensions. These chains are defined via the Hamiltonian

$$H = \sum \left[\tfrac{p_j^2}{2} + \tfrac{1}{2}(q_{j+1} - q_j) + \tfrac{a}{2}(q_j)^2 + \tfrac{b}{2}(q_j)^2 \right]$$

$$p_j = q_j.$$

The periodic lattices with two particles and a nonlinear potential is shown to be non-integrable. In the case of a lattice of up to 6 particles, the Birkhoff-Gustavson normal forms are shown to be integrable.

In paper [36], the Klein-Gordon lattice with periodic boundary conditions, which is a Hamiltonian system with N degrees of freedom, is considered. Using the theory of Morales-Ramis - Simo it is shown that it is non-integrable in the Liuville sense. Also in this paper, the resonance Birkhoff normal forms of the Klein-Gordon Hamiltonian restricted to order 4 are considered. These normal forms are shown to be integrable. For N odd, it is shown that this integrable normal form is a KAM non-degenerate Hamiltonian. The Klein-Gordon lattice with Dirichlet boundary conditions is shown to admit an integrable KAM non-degenerate normal form of order 4.

In paper [37] a Hamiltonian normal form in 1:2:2 resonance is studied. Investigates the non-integrability of this normal form limited to order 4. The non-integrability is proved using the Morales-Ramis theory and only the first variational equations of some partial solutions. A non-trivial case of integrability is also found.

In paper [38] the integrability of the 3D Henon-Hale system is considered

$$H = \frac{1}{2}(p_1^2 + p_2^2) + \frac{1}{2}(Aq_1^2 + q_2^2) + \alpha q_1^2 q_2 + \frac{\beta}{3} q_2^3.$$

This system is known to be integrable in the Liouville sense in the following cases

$$1.\alpha = \gamma, \quad \tfrac{\alpha}{\beta} = 1, \quad A = B = C$$

$$2.\alpha = \gamma, \quad \tfrac{\alpha}{\beta} = \tfrac{1}{6}, \quad A = C$$

$$3.\alpha = \gamma, \quad \tfrac{\alpha}{\beta} = \tfrac{1}{16}, \quad A = C, \quad \tfrac{A}{B} = \tfrac{1}{16}.$$

Using Morales-Ramis theory it is shown that there are no other integrability cases for this system.

In paper [39] the following Hamiltonian is considered

$$H = H_2 + H_3 + ... + H_j + ...$$

where $H_2 = \sum \omega_j (x_j^2 + y_j^2)$, $\omega_j > 0$ and H_j are homogeneous polynomials of order j. The frequency vector $\omega = (\omega_1, ...\omega_n)$ is of resonance $\mathbf{k}$, if there is k_j, such that $\sum k_j \omega_j = 0$ and $\sum |k_j| = \mathbf{k}$. In the case of the 1:2:1:2 Hamiltonian

normal form limited to order 3, several cases of integrability are known. New cases of integrability are found in this paper. Having analyzed the first variational variables, the surrounding partial solutions are unmeasured in terms of non-integrability of the Hamiltonian system.

6. Critical notes and recommendations

I have no critical comments on the materials of Prof. Ognyan Christov.

7. Personal impressions of the candidate

I have known Prof. Christov since 2004 and highly appreciate his professional activity. He is an excellent teacher who treats students fairly and benevolently. His scientific articles present him as a serious researcher. In addition, it can be seen that he knows how to work in a team.

8. Application conclusion

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 ZRASRB, 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. In particular, the candidate satisfies the minimum national requirements in the professional direction 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 of the Faculty of Mathematics and Informatics at SU "St. Kliment Ohridski"to elect Associate Professor Ognyan Borisov Christov to occupy the academic position of "Professor"in professional direction 4.5 Mathematics (Differential equations, Hamiltonian systems).

12.102023 г.

Prepared the review:
Prof. DrSci Sevdzhan Hakkaev