

OPINION

by Prof. Dr. Velizar Todorov Pavlov, University of Ruse,
member of the scientific jury,
appointed by order of the Director of IMI № 105 / 15.06.2021
in connection with a competition for the academic position of
"Associate Professor" for the needs of IMI
in field 4. Natural sciences, Mathematics and Informatics
professional field 4.5. Mathematics,
scientific specialty "Differential equations"
announced in the State Gazette no. 30/13.04.2021

The only candidate: **Dr. Borislav Tsonev Yordanov**

The opinion is prepared in compliance with the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (RASRB), the Regulations for its implementation (PPZRASRB), as well as the Regulations for the conditions for acquiring scientific degrees and holding academic positions (PURPNSZAD) at the Institute of Mathematics and Informatics (IMI) of BAS.

For the preparation of my opinion, I was presented the following items by the candidate: professional CV, general list of publications, list of publications for participation in the competition (18 issues with numbering [1], [2], ..., [18]), copies of publications for participation in the competition, reference for the scientific contributions, summaries of the publications for participation in the competition, general list of citations, list of citations for participation in the competition, reference for the fulfillment of the minimum requirements for holding the academic position "Associate Professor" at IMI BAS.

During the implementation of the procedure, no violations of the regulations, the terms and the minimum national requirements according to ZRASRB, PPZRASRB, as well as the specific requirements of IMI of BAS according to PURPNSZAD have been observed.

1. Biographical data about the candidate.

Dr. Borislav Yordanov graduated from the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski" with Master's degree in mathematics. Thesis topic: "Global solutions of nonlinear wave equations with small potentials" under the guidance of Prof. Vladimir Georgiev. In 2002, he defended his doctoral dissertation on "Global solutions of nonlinear wave equations with dumping" at the University of Wisconsin - Milwaukee, USA under the supervision of Prof. Albert Milani. His diploma was legalized in Bulgaria in 2014. During the period 01.1994 - 09.1998, he was a research associate, and since 2013 he has been an assistant at the IMI of BAS. He has a solid teaching experience as a an "assistant" abroad: Hokkaido University, Sapporo, Japan, from 2016 until now; University of Tennessee-Knoxville, Tennessee, USA 08.2012 - 08.2013

and 08.2004 - 07.2007; University of California-Riverside, California, USA 08.2002-08.2004.

2. Information about the presented materials.

The candidate participates in the competition with 18 scientific publications. All publications are in the form of articles in scientific journals, referenced and indexed in world-famous databases with scientific information, with impact factor (IF) and impact rank (SJR).

by relevance: magazine articles:

indexed by Web of Science with impact factor (IF) in Q1 - 15 items;

indexed by Web of Science with image factor (IF) in Q2 – 2 items;

indexed by Web of Science with image factor (IF) in Q3 – 1 item;

indexed by Scopus with impact-rank (SJR) - 18 items.

by language of publication: all articles are published in English.

by number of co-authors:

with one co-author - 9 publications;

with two co-authors – 8 publications;

with four co-authors – 1 publication.

I would like to note, in particular, that all publications are in scientific journals with impact factor and impact rank with an impressive total impact factor of 30,136 and a total impact rank of 31,392. The journals, in which the papers were published, are known for their thorough review of the submitted articles.

The candidate has provided a total list of 766 citations of his works, as well as a list of 466 citations of his publications submitted for participation in the competition. The most cited article [17], published in 2006, has 106 citations, which I think is an enviable achievement. I can add that Dr. Yordanov has an H-index = 14 (Scopus) and H-index = 13 (Web of Science), which is an indicator of significant international recognition for his scientific work.

In accordance with ZRASRB, PPZRASRB and PURPNSZAD of IMI of BAS, a reference has been prepared by the candidate for the fulfillment of minimum scientific requirements for holding the academic position "associate professor" in PN 4.5. Mathematics. After my careful examination, I can conclude that all the requirements are not only met, but also significantly exceeded.

3. General characteristics of the research activity of the candidate, according to the publications submitted for participation in the competition.

The research of the candidate, presented for participation in the competition, can be structured into the following scientific directions:

3.1. Low-frequency approximations of the solutions of wave equations with linear attenuation and their applications. Publications [1], [6], [8], [9], [10], [11], [12] and [14] fall into this direction.

In [1], elliptic equations of the second order, in divergent and non-divergent forms,

with measurable complex coefficients of the main part and with measurable complex potentials are investigated. The existence and uniqueness of the solutions has been proved and estimates have been obtained in Sobolev spaces. It has been established that the non-zero complex parts of the potentials determine the behavior of solutions. In [2], the asymptotic behavior of solutions to dissipative wave equations involving two non-commuting self-adjoint operators in Hilbert space was studied. The phenomenon of abstract diffusion was observed. Sharp estimates of the decay of solutions are given and important applications are presented. In [8], the Cauchy problem for abstract equations with dissipation in Hilbert spaces is considered, which generalizes the wave equation with strong dissipation. It has been established that the asymptotics for large times of wave equations with strong dissipation is a combination of the solutions of diffusion and wave equations. In [9], the asymptotic behavior of the solutions of a wave equation with a variable dissipative term in the case of critical decay is studied. In [10], a version of the abstract diffusion phenomenon was proposed in which a strong relationship was established between the asymptotic behavior of abstract parabolic and dissipative hyperbolic equations. In [11], weighted L^2 estimates for dissipative wave equations with variable coefficients are derived. The method of multipliers, which are specially selected from the asymptotic profiles of the corresponding parabolic equations, is used in the proofs. The same method was applied in [12], where weighted estimates for a variable coefficient dissipative wave equation were derived. In [14], the balance between the effects of the spatial inhomogeneity of the potential in the dissipative term and the focusing nonlinearity is studied.

3.2. Asymptotic behavior and smoothness of solutions of wave equations with nonlinear dissipation. Publications [4], [5], [7], [13] and [16] fall into this direction.

In [4], the problem of energy decay for the nonlinear dissipative wave equation in dimension one is considered. A polynomial rate of convergence to zero is proved when the degree of nonlinearity is between one and three. In [5], the nonlinear wave equation $u_{tt} - \Delta u + |u_t|^{p-1} u_t = 0$ is considered, for which it is proved that there exists a unique solution in the Sobolev spaces of radially symmetric functions. In [7], generalized nonlinear wave equations of the type $u_{tt} - \Delta u + f(u) + g(|u_t|) = 0$ are considered, for which the global existence and uniqueness of solutions are proved. It was found that the nonlinear dissipation creates a new monotonic functional, which includes the second-order derivatives of the solution and leads to a priori estimates for initial data of arbitrary size. In [13], a nonlinear wave equation of the form $u_{tt} - \Delta u + u_t^3 = 0$ is considered, for which it is proved that there exists a unique global solution in radially symmetric Sobolev spaces. In [16], wave equations with nonlinear dissipation are considered, for which the asymptotic behavior of energy as time tends to infinity is studied. The main result shows a polynomial decay rate of energy.

3.3. Absence of global solutions of wave equations with power nonlinearity.

Publications [2], [3], [15], [17] and [18] fall into this direction.

In [2], the Cauchy problem for the semilinear wave equation with variable coefficients and time-dependent scattering damping is considered. A generalization of the results of Lai and Takamura (2018) on the blow-up of solutions was obtained and an upper limit on the time of their existence was found. In [3], semilinear wave equations with variable coefficients are considered and the blow-up of their solution is studied. [15] is a review article in which the Cauchy problem for the equation of linear and nonlinear viscoelasticity with memory is considered. The dispersion properties of the solutions of the linear equation of viscoelasticity with memory are studied. The obtained estimates were used to study the nonlinear case of the Cauchy problem. In [17], it was proved that the solutions to the critical semilinear wave equations in high dimensions cannot be global, provided that the initial data are somewhere positive and everywhere non-negative. In [18], the blow-up of solutions to the semilinear wave equation with positive potential was studied.

I can conclude that the research activity of the candidate is entirely in the field of differential equations, which is in full compliance with the scientific specialty of the announced competition.

4. Evaluation of scientific contributions.

The candidate's contributions are scientific in nature. In general, they can be divided into three groups.

1. Investigations of the solutions to the Cauchy problem for wave equations with dissipation at large times.
2. Investigations of the interaction between nonlinear damping and nonlinear source in wave equations.
3. Investigations of the solutions to the Cauchy problem with a small parameter for semilinear wave equations with variable coefficients, where special attention is paid to the case of blow-up of solutions.

The scientific contributions are based on the 18 publications by which Dr. Yordanov participates in the competition. All publications are co-authored, where I accept that the personal contribution of the candidate is equal to that of the other co-authors. I define all contributions as original and essential for science and practice. I find no evidence of plagiarism.

5. Assessment of the teaching activity of the candidate.

As an Assistant Professor at Hokkaido University, Sapporo, The University of Tennessee-Knoxville, Tennessee and the University of California-Riverside, California, Dr. Borislav Yordanov has a solid teaching background. It is related to courses in Linear Algebra, Mathematical Analysis, Ordinary Differential Equations, Vector Analysis, Partial Differential Equations and Numerical Methods. He was the research supervisor of a successful master's degree graduate. There are very good reviews from students about his

teaching work.

6. Critical remarks and recommendations.

The report on scientific contributions, presented by Dr. B. Yordanov, rather resembles extended summaries of scientific papers. I believe that the claims for scientific contributions should be formulated in a more synthesized and precise form.

I recommend Dr. Yordanov to find a suitable form for application in Bulgaria of the accumulated teaching experience abroad. Special courses in the field of differential equations, led by him, would be interesting.

7. Conclusion.

Based on the presented scientific papers, their significance, the scientific contributions contained in them, having in mind the requirements of ZRASRB, the Regulations for its application and PURPNSZAD of IMI of BAS, I strongly propose the candidate Dr. Borislav Tsonev Yordanov to take the academic position "ASSOCIATE PROFESSOR" at IMI of BAS, in professional field 4.5. Mathematics, scientific specialty Differential equations.

Signature of the author of this opinion:

Prof. Dr. Velizar Pavlov

08.08.2021