OPINION

by Assoc. Prof. Todor Pavlov Popov, PhD,
Faculty of Mathematics and Informatics, Sofia University "St. Kliment Ohridski"

on the competition for the occupation of the academic position Associate Professor in the professional field 4.5 Mathematics, Differential Equations, at the Institute of Mathematics and Informatics – BAS, announced in State Gazette no. 30 of 13.04.2021,

With applicant: Asst. Prof. Borislav Tsonev Yordanov, PhD

I present my opinion on this competition as a member of the Scientific Jury according to Order 105 from 15.06.2021 of the Director of the Institute of Mathematics and Informatics – BAS. The following documents and materials have been provided to me: application for participation in the competition, CV, diploma of higher education, PhD diploma, full list of publications, the list of publications for participation in the competition, copies of the publications, author's reference for scientific contributions, the abstracts of the publications, full list of citations, a list of citations for participation in the competition, competition announcement in the State Gazette, certificate of internship, reference-form for compliance with the minimum national requirements, declaration form 3.2, declaration on personal data processing.

Biographical data for the applicant

Borislav Yordanov graduated from the Faculty of Mathematics and Informatics of Sofia University "St. Kl. Ohridski" in 1995. In 2002 he defended his thesis and obtained PhD degree at the University of Wisconsin – Milwaukee. He was a research associate at the Institute of Mathematics and Informatics – BAS between 1994 and 1998, an associate member in the period 2010–2013, and since 2013 he is Assistant Professor. Since 2002 he has been a lecturer at the University of California-Riverside, University of Tennessee-Knoxville (USA), Hokkaido University (Japan). The presented CV of the candidate shows that he has solid pedagogical experience.

Scientometric indicators according to the minimum national requirements

Here I will evaluate the publications submitted by the candidate according to the indicators under Art. 2b, para. 2 of the Law for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), described in the Appendix to Art. 1a, para. 1 of the Regulations for application of ZRASRB, and the Regulations on the terms and conditions for acquiring scientific degrees and for academic positions at the Institute of Mathematics and Informatics at BAS.

By group of indicators A, indicator 1: Borislav Yordanov has PhD degree – 50 points. By group B, indicator 4: 50 points for each of the publications [2], [3], [7] and [8] from the

presented list of publications for the competition, which are in Q1 journals in Web of Science – a total of 200 points.

By group Г, indicator 7: 50 points for each of the scientific papers [1, 4, 5, 6, 10, 11, 12, 15, 16, 17, 18] in Q1 of Web of Science; 40 points for both papers [9] and [14] in Q2; 30 points for the publication [13] in Q3. By group Д, indicator 11: 6 points for 24 citations in scientific journals, referenced and indexed in Web of Science and Scopus, indicated in the presented list of citations for participation in the competition.

By group Е, the applicant indicates that he had participated in one national (indicator 14, 10 points) and one international scientific project (indicator 15, 20 points).

Group of indicators	А	В	Г	Д	Е
Applicant's points	50	200	660	144	30
Minimum requirements of IMI-BAS for associate professor	50	100	220	70	20
Minimum requirements of IMI-BAS for chief assistant professor	50		30		

Based on the materials and documents presented in the competition, I conclude that the applicant meets the minimum requirements for scientific research for the academic position of Associate Professor in the professional field 4.5. Mathematics.

General characteristics of the applicant's scientific research

For participation in the competition the applicant has submitted eighteen publications that have not been used in previous procedures. All submitted articles are in the scientific field of the competition. In co-authorship with colleagues from abroad, strong results have been obtained, and have been published in prestigious and leading scientific journals in the field – Journal of Differential Equations, Nonlinear Analysis, Transactions of the American Mathematical Society, Journal of Mathematical Analysis and Applications and others.

The main part [2–18] of the presented scientific papers is related to the study of the behavior of solutions to the Cauchy problems for linear or semilinear hyperbolic partial differential equations.

In [6, 9–12, 14] Cauchy problems are considered for wave equations with linear damping – a linear term with a lower order derivative u_t with a positive and space-dependent coefficient. In [9, 11, 12] the linear homogeneous equation is considered, and in [14] – a semilinear equation with a nonlinear source of the form $|u|^{p-1}u$. With the help of appropriate weighted energy estimates, the rate of the decay of the L_2 norm of the solution with respect to the spatial variables when the time $t \to \infty$ is evaluated. The asymptotic behavior of the solutions of the linear equation at $t \to \infty$ is studied in [6, 10]. It is shown that their behavior is comparable to that of the solution to the corresponding parabolic equation and an estimate for their difference is obtained.

Publications [4, 5, 7, 13, 16] deal with Cauchy problems for wave equations with n spatial variables with nonlinear damping of the form $|u_t|^{m-1}u_t$. In [4, 16] it is proved that the energy decay is polynomial when $m \in (1,1+1/(n+1)]$, which is an improvement of a previous result for the logarithmic rate of decay. For $m = 3$ and $n = 3$, for the radially symmetric case, in [13] the existence and uniqueness of a k-smooth solution is proved for the Cauchy problem with initial data for $u|_{t=0}$ and $u_t|_{t=0}$ from $H^k(R^3)$ and $H^{k-1}(R^3)$ respectively, where $k > 2$ is an integer. In [5] the results are extended also for $m > 3$ using the fact that due to the radial symmetry the dimension of the problem can be reduced and techniques for one-dimensional problems are applied. These, in a sense, are a continuation of a result of Lions and Strauss for $k \in [1,2]$.

For dimension $n = 3$, in the work [7] equations with nonlinear damping and with positive and defocusing nonlinear source of the form $|u|^{p-1}u$ are considered. For $m > 2$ and $p > 2$, the existence and uniqueness of a strong solution of the Cauchy problem with initial conditions from $H^2(R^3)$ and $H^1(R^3)$ is proved. Additionally, specifically for $m = 5/3$ and the critical value $p = 5$, the existence and uniqueness of a weak solution is shown for initial data from $H^1(R^3)$ and $L_2(R^3)$. This choice of parameters does not satisfy the "usual" condition $p + p / m < 6$. The results relay on the obtained energy identities and estimates.

The publications [17, 18] consider a semilinear equation for a wave operator with a nonlinear source of the form $|u|^p$. In the supercritical case – i.e., for values of p greater than the critical Strauss number $p_0(n)$, the Cauchy problem is globally solvable. In the subcritical case $1 < p < p_0(n)$ the solution blows up at a finite time. In [17] it was found that the solution blows up also in the critical case $p = p_0(n)$ when $n > 3$. In [18] for an equation in which a positive potential is added, it is shown that the solution blows up for $1 < p < p_0(n)$. The method of the proof is based on estimates for the mollified solution with an appropriate mollifying function. In the more recent works [2, 3] it is also shown that the solution blows up in the critical case, but now the hyperbolic operator in the equation has variable coefficients. A convenient mollifying function is constructed and as a result upper bounds of the lifespan of the solution are found.

In the recent paper [1] second-order elliptic equations with complex coefficients, right-hand side, and potentials are studied. Under appropriate sufficient conditions, the existence and uniqueness of strong (from the Sobolev space $W^{2,p}(R^n,C)$) and weak (from $W^{1,p}(R^n,C)$) solutions is proved and some estimates for the solutions are found.

Critical notes and recommendations

I have no significant remarks on the submitted materials, related to the scientific research of the applicant. However, I think that the applicant could have provided more detailed information about the research projects in which he participated – only their names are mentioned in the table in the reference-form for the compliance with the minimum national requirements. There was another paper in place of [4] in the copies of the applicant's scientific publications that I received. I will also mention that in the application documents, the copy of the competition announcement is for a previous competition of IMI – BAS in different issue of the State Gazette. I consider this to be a minor technical error – nowadays the issues of the State Gazette are easily accessible online.

Conclusion

From the analysis of the materials submitted in this competition I find that Asst. Prof. Borislav Yordanov meets all the requirements of ZRASRB, the Regulations for the implementation of ZRASRB, as well as the Regulations on the terms and conditions for the academic positions at the Institute of Mathematics and inomatics – BAS. In particular, in the main group indicators В, Г and Д, the applicant exceeds several times the amount of points over the minimum requirements.

Based on the above, I strongly recommend the scientific jury to evaluate positively the applicant and to propose to the Scientific Council of IMI – BAS to elect Asst. Prof. Borislav Yordanov for the academic position Associate Professor in the professional field 4.5. Mathematics, Differential equations.

Sofia, 10.08.2021 Prepared by:

Assoc. Prof. Todor Popov