

REVIEW
on the competition for the academic position
“Associate Professor”
in the professional field 4.6. Informatics and Computer Sciences
(Programming),
for the needs of Sofia University „St. Kliment Ohridski“ (SU),
Faculty of Mathematics and Informatics (FMI),
announced in SG No. 21 from 15.03.2022 and on the Internet sites of FMI and SU

Review prepared by: **prof., dr. Vladimir Todorov Dimitrov - FMI at SU “St. Kliment Ohridski”**, as a member of the scientific juri on the higher education area 4. Natural sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Sciences and by the Order № ПД 38-232/11.05.2022 of the Rector of Sofia University.

Only one candidate has submitted documents for participation in the announced competition: Senior Assistant, Dr. Ivan Georgiev Hristov, from the Department of Computer Informatics, FMI, SU “St. Kliment Ohridski”.

I. COMMON DESCRIPTION OF APPLIED MATERIALS

1. Information about the application

The submitted documents from the applicant meet the requirements of the ADAS in RB, the RAADAS in RB and The Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at Sofia University “St. Kliment Ohridski” (RTCAADOAPSU).

For participation in the competition, the candidate, senior assistant professor Ivan Georgiev Hristov applied a common list of 37 titles in Bulgarian and foreign scientific journals and scientific forums. Twelve publications are applied for this competition.

Fifteen types of documents are presented according to the list of documents for application that show the candidate achievements.

The presented list of documents meets the requirements of the ADAS in RB, the RAADAS in RB and RTCAADOAPSU for participation in the competition for “associate professor”.

2. Information about the candidate

Senior Assistant, Dr. Ivan Georgiev Hristov, graduated in 2004 with a bachelor's degree in Applied Mathematics, and in 2007 with a Master's degree in Mathematics, Master's program in Computational Mathematics, and then in 2014 with a Doctorate in Mathematics (Mathematical modelling and applications of mathematics) at FMI at Sofia University "St. Kliment Ohridski".

The topic of the dissertation is "Numerical study of static and dynamic regimes in multilayer Josephson junctions".

In the period 2007-2010, he has been Assistant, 2010-2011 - Senior Assistant, 2011-2018 - Senior Assistant at the Department of Numerical Methods, and from 2018 until now, he is Senior Assistant at the Department of Computer Informatics at FMI at Sofia University "St. Kliment Ohridski".

3. General characteristics of the applicant's scientific work and achievements

The publications on the competition are in the following thematic groups:

1. Parallel calculations - 6 publications;
2. Numerical simulations of static and dynamic regimes in Josephson junctions - 6 publications.

A detailed examination of the scientific results follows in Section 5.

Twelve publications are applied for this competition.

Previous competition is the only one - in this case, it is for ESD "Doctor". Publications [7-12] from the list submitted for the competition, I do not consider because they are related to the defended dissertation and have been published before the date of dissertation defense. Therefore, below I set out in more details the coverage of the Minimum national requirements for "Associate Professor".

In calculating the minimum requirements for "Group of indicators B", "Indicator 4: Habilitation work - scientific publications in publications that are referenced and indexed in world-famous databases of scientific information (Web of Science and Scopus)" publications [1-4] from the list of publications submitted for participation in the competition. Of the required 100 points, there are 120 points.

In calculating the minimum requirements for "Group of Indicators Γ ", "Indicator 7: Scientific publications in publications that are referenced and indexed in world-renowned databases of scientific information (Web of Science and Scopus), outside the habilitation the-

sis" was used. The required 200 points are achieved according to the common list of publications.

"Group of indicators Д", "11. Cited in scientific journals, monographs, collective volumes and patents, referenced and indexed in world-renowned databases of scientific information (Web of Science and Scopus)*" is correctly calculated in the reference. 6 cited publications (in Scopus and WoS) and 7 cited publications are given. Out of 50 required points, there are 56 points.

I accept that the scientific works meet the minimum national requirements (under Art. 2b, para. 2 and 3 of ADAS in RB) and respectively the additional requirements of Sofia University "St. Kliment Ohridski" for holding the academic position of "Associate Professor" in the scientific field and professional direction of the competition.

There is no legally proven plagiarism and at least I am not aware of such in the scientific papers submitted at the competition.

4. Characterization and evaluation of the applicant's teaching activity

The teaching activity of the candidate in FMI covers the following disciplines: Introduction to programming, Object-oriented programming and Data structures and programming. These disciplines are for bachelors in Applied Mathematics, Mathematics, and Statistics. The candidate has led exercises and lectures in these disciplines.

I have observations on the work of the Senior Assistant, Dr. Ivan Georgiev Hristov as a lecturer and I believe that he has the necessary skills for this activity.

5. Substantive analysis of the scientific and applied scientific achievements of the candidate contained in the materials for participation in the competition

I accept the thematic areas of applied materials as presented by the candidate. I consider the publications [1-7] from the list of publications submitted for participation in the competition.

Parallel calculations

This thematic group covers the publications [1-6] of the works submitted for participation in the competition.

In [1] a parallelization of the Taylor method with a variable step for connected Lorentz systems is presented. This solution is for OpenMP. The GMP library is used. A reliable solution has been obtained in a time interval [0, 400]. Two Intel Haswell processors (32 cores)

were tested. The acceleration is 23.1 with a parallel efficiency of 72.1%. The parallelization approach can also be used for other dynamic systems.

In [2], an effective MPI + OpenMP parallelization of the Taylor method with a variable step and a fixed order for the classical Lorentz system is proposed. This publication is a continuation of the work presented in [1]. A high order of accuracy of the Taylor method was used - 5490, combined with high precision - 4778 decimal places. The world record for the longest reliable trajectory of the Lorentz system has been improved - [0, 11000].

In [3] the simulation of standing waves in natural Josephson junctions by solving a system of perturbed 2D sinus equations of Gordon is considered. Implementation is through OpenMP and two threads and SIMD are used. Parallelism on two levels is applied here. Two Intel architectures were tested: a $2 \times$ Xeon E5-2695 v2 processor (codenamed "Ivy Bridge-EP") in the Hybrilit cluster and a Xeon Phi 7250 processor (codenamed "Knights Landing" - KNL).

In [4] a hybrid MPI + OpenMP program for numerical solution of systems of perturbed 2D sinus equations of Gordon by leapfrog differential circuit is presented. Tests were conducted on the platform in the IICT-BAS cluster, Bulgaria, with an acceleration of about 11 (for 16 cores), and on the HybriLIT cluster, JINR, Russia, with an acceleration of about 30 (for 48 cores).

In [5] the same problem is solved as in [4]. The tests were conducted at the computational cluster of IICT-BAS. Standing wave monitoring parameters are defined. The obtained results explain the experiments with strong THz radiation of BSCCO crystals.

In [6] a numerical class of combined explicit-implicit Taylor methods with different order of accuracy for solving Hamiltonian systems was studied. Tests show that the implemented methods are considered to be symplectic in terms of energy conservation and in some cases may be superior to Verle's standard second-order method. The OpenMP platform was used to calculate multiple independent trajectories. The tests were performed on the HybriLIT platform (48 cores).

Numerical simulations of static and dynamic regimes in Josephson junctions

This topic is a direct continuation of the candidate's dissertation. Only one publication remained is here [7]. It proposes a differential scheme based on finite differences for solving a system of perturbed Gordon sinus equations with fixed parameters and zero or random initial conditions. From the performed numerical studies, it follows that the state in phase is the natural state of the Josephson junctions about certain values of the external magnetic field and external current. This condition is an attractor for the system. Grid computing infrastruc-

ture was used. The task is divided into many parts and the results are programmatically combined.

In the materials co-authored, the candidate apparently indicated his personal contribution. Usually, this is in the parallelization and implementation of the software.

6. Critical notes and recommendations

There are certain omissions in the preparation of the materials for the competition, which, in the end, do not affect the presentation of candidate achievements.

In general, in most of the candidate's publications the scheme is followed: mathematical problem, parallelization, reporting of the obtained results. In this regard, I would recommend adding two more elements: the application of the solved mathematical problem and a detailed study of the parallel algorithm.

The first recommendation is related to the positioning of the problem to be solved. The application of solved problem is not obvious to the reader of the article if he does not know the topic in depth and in advance.

The second recommendation is because even if the experimental results justify successful parallelization, there are configurations and systems in which the results would be compromised. In this case, the precise evaluation of the algorithm can be done by formulas for speed, throughput, etc.

7. Personal impressions of the applicant

I know the candidate from 2015 in the cooperation with JINR, Dubna, Russia, for which I represent the FMI in the Expert Commission for Cooperation with JINR. I have always received positive feedback from the researchers and the management of LIT at JINR for his work.

Since 2018, the candidate is a member of the Department of Computer Informatics. The nature of the research activity of Senior Assistant, Dr. Ivan Hristov - Applied Mathematics, has imposed over the specialization in the use of computers for their application in computational problems. This deepened his knowledge in the field of programming and parallel algorithms, which determined his path to Informatics.

From 2018, the candidate conducts lectures and exercises in the basic programming courses Introduction to Programming and Data Structures and Programming. Excellent handling of the subject allowed the department to entrust not only exercises but also lectures in these disciplines and finally this concurs for academic growth.

8. Conclusion on the application

Having become acquainted with the materials and scientific works presented in the competition and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, I **confirm** that the scientific achievements meet the requirements of the ARAS in RB, the Regulations for its implementation and the corresponding Regulations of SU “St. Kliment Ohridski” for appointment on the academic position “associate professor” in the science area and professional field of competition. In particular, the candidate meets the minimum national requirements in the professional field and it is not found plagiarism in submitted of scientific works in the competition.

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

II. OVERALL CONCLUSION

Based on the above, I recommend to the scientific jury to suggest to the competent authority in the selection of the Faculty of Mathematics and Informatics at SU “St. Kliment Ohridski” to elect Senior Assistant, Dr. Ivan Georgiev Hristov to take the academic position “Associate Professor” in the professional field 4.6. Computer Science and Informatics.

19.06. 2022

Review prepared by: .
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