



Opinion

on the competition for the academic position "professor" in professional field 4.5.
Mathematics, specialization Computational Mathematics (high-performance methods and algorithms), announced in State newspaper No. 45 / 28.05.2021 with only candidate Assoc. Prof. Dr. Ivan Dimov Lirkov
Reviewer: Prof. Ivan Tomov Dimov -
Institute of Information and Communication Technologies, Bulgarian Academy of Sciences

The following documents were submitted to the reviewer:

1. European CV
2. Copy of diploma for educational and scientific degree "doctor"
3. Certificate of work experience in the specialty.
4. List of scientific publications with which Assoc. Prof. Dr. Ivan Lirkov participates in the competition.
5. List of citations of publications of Assoc. Prof. Dr. Ivan Lirkov.
6. Summaries of the publications of Assoc. Prof. Dr. Ivan Lirkov, presented at the competition - in English and Bulgarian.
7. Copies of the scientific publications with which Assoc. Prof. Dr. Ivan Lirkov participates in the competition.
8. Information on the fulfillment of the minimum requirements of IICT for the academic position "professor".
9. Information on the original scientific and scientific-applied contributions
10. Declaration that there is no legally proven plagiarism in the scientific works of Assoc. Prof. Dr. Ivan Lirkov.
11. Electronic information carrier according to the requirements of IICT-BAS.

1. General characteristics of the scientific results

The candidate Assoc. Prof. Dr. Ivan Lirkov participates in the competition for professor with publications, the list of which includes 44 scientific papers. Of the 44 publications submitted for the competition, 37 are in international journals and series, and 7 are in refereed proceedings at international conferences. These publications do not repeat those presented for the acquisition of the educational and scientific degree "Doctor" and for the academic position "Associate Professor". Five of the publications are in impact factor journals.

In this sense, the scientific problems considered and the tasks solved by him in the presented scientific publications are within the professional field 4.5. Mathematics, and relate to the scientific field 01.01.09 Computational mathematics, including the creation and implementation of high-performance methods and algorithms for scientific computations.

2. Contributions contained in submitted works for review

The obtained results can be conditionally structured in three directions. They are formulated in a slightly different way from that of the applicant, namely:

1. Methods for approximate solution of two-dimensional and three-dimensional boundary value problems of mathematical physics;
2. Methods and algorithms for solving optimization problems;
3. Parallel algorithms for distributed computing systems.

In the first scientific field "Methods for approximate solution of two-dimensional and three-dimensional boundary value problems of mathematical physics" the main results are published in [1-7,9,13,18,22,31,41]. In [1-5] a parallel algorithm for numerical solution of the Stokes equation for incompressible fluid is presented. The approach presented uses the method of division by directions. The method is based on projection schemes, which are widely used in the computational dynamics of fluids. The algorithm uses a Crank-Nicholson computational scheme. In [9] a method for numerical solution of systems of second-order partial differential equations of convection-diffusion type was studied. In [13,18] a three-dimensional linear problem from the theory of elasticity is considered. The problem is described by a system of second-order partial differential equations. Two efficient parallel algorithms have been constructed. In [22], a parallel implementation of the conjugate gradient method with a preconditioner (modified incomplete factorization MIC (0)) for solving the systems of partial differential equations arising from the numerical homogenization of human bone microstructures was studied. In [41], a computer model of radiofrequency ablation of liver tumors was developed, which includes thermal and electrical processes in liver tissue.

The results in the second scientific field "Methods and algorithms for solving optimization problems" are contained mainly in the works [11,16,40,44,]. In [11,16] the problem of the spatial arrangement of amino acids in protein molecules is considered. I should note that this is a fundamental task in computational molecular biology and biochemical physics. Various optimization methods are applied, in particular Monte Carlo. In [40], a parallel implementation of an image reconstruction algorithm using Anscombe transformation to solve a convex optimization problem with constraints is analyzed. In [44] a comparative analysis of the performance of two algorithms for the reconstruction of tomographic images using Anscombe transformation to solve a convex optimization problem with constraints is made.

I will also briefly mention the main achievements in the third direction, namely "Parallel algorithms for distributed computing systems". Here I want to mention the task of using autonomous software agents in computer networks [8]. [14] examines how the agent infrastructure designed to provide the "brain" can connect to the "muscles" to fulfill user

requests in it. In [17], a model for running different Grid applications on distributed computing systems was studied, using a system of agents for the negotiation process between the user and the owner of the computing resources. In [21], issues related to duplication of information in the Grid resource management system are analyzed. A method for applying ontologically presented knowledge in support of Grid users has been proposed in [26]. In a number of publications related to this scientific field, numerous experiments have been conducted on the Avitohol supercomputer in IICT-BAS.

In short, the main contributions can be formulated as follows.

- Parallel algorithms for numerical solution of two-dimensional and three-dimensional Stokes equation for incompressible fluid have been developed. A version designed to run on massively parallel computers has been created.
- A parallel algorithm for solving systems of partial differential equations of the second order of convection-diffusion type has been developed, and for solving the system of linear algebraic equations obtained after sampling the generalized conjugate gradient method is applied.
- The parallel properties of circular block factorization (CBF) algorithms for solving systems with poorly conditioned dilute matrices have been studied.

The scientific and applied contributions are:

- Experimental study of the performance of parallel execution of an image recovery algorithm. A hybrid parallelization based on MPI and OpenMP was studied.
- An algorithm for parallel realization of three-dimensional discrete transformation on a computer system, in which the communications between the computing nodes are performed in a three-dimensional toroidal network, has been studied.

3. Publications and citations of publications participating in the competition

The topicality and significance of the scientific and scientific-applied contributions are indisputable. They follow from the fact that most of the publications are in authoritative specialized publications with impact factor and SJR rank.

Assoc. Prof. Ivan Lirkov has documented 64 citations of the publications presented for the competition in Scopus/WoS, which testifies to its international recognition. Two of the publications submitted for the competition are independent and the others are collective. Let me note, however, that in the field in which the competition is, it is natural to work in teams. At the same time, the personal participation of the candidate in the joint publications does not arouse any doubt. In each of the joint works the candidate has the necessary significant

contribution.

4. Educational activity and participation in projects

The reference submitted by the candidate states that he has led 4 national research projects and has also been the leader of the Bulgarian team in 2 international research projects. He has participated in 6 national research projects and 10 international research projects.

I did not find information in the documents on the competition that he supervised doctoral students or graduates.

5. Comments and recommendations

I have no remarks or recommendations to Assoc. Prof. Ivan Lirkov. I am satisfied with the way the documents for the competition have been prepared.

5. **CONCLUSION.** Based on the aforementioned, it is clear that the candidate for the announced competition Assoc. Prof. Dr. Ivan Lirkov fully complies with the requirements of the ZRASRB, the Rules for the implementation of the ZRASRB, the Rules for the conditions and procedures for acquiring academic degrees and for occupying academic positions in BAS, as well as the Rules for the Specific Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences. The scientific results achieved give me reason to propose the selection of the candidate Assoc. Prof. Dr. Ivan Lirkov for a professor at IICT-BAS in professional field 4.5. Mathematics, specialization Computational mathematics (high-performance methods and algorithms).

Therefore, my conclusion for holding the academic position "Professor" announced by the competition by Assoc. Prof. Dr. Ivan Dimov Lirkov is POSITIVE.

08/30/2021

Sofia



/ Prof. Ivan Dimov /