STATEMENT

by Prof. Dr. Aneta Nedeva Karaivanova, IICT-BAS

of the materials submitted for the competition
for the occupation of the academic position of "Professor"
at the Institute of Information and Communication Technologies - BAS
in the professional field 4.5 Mathematics,
specialty "Mathematical modeling and application of mathematics (Monte Carlo and quasi-Monte Carlo algorithms and applications)"

<u>Reason for this statement</u>: By order # 178 / 19.07.2019 of the Director of IICT-BAS I was appointed a member of the scientific jury of the competition for the occupation of the academic position "Professor" in the professional field 4.5 Mathematics, specialty Mathematical modeling and applications of mathematics (Monte Carlo and Quasi-Monte algorithms and applications) announced in State Gazette, no. 41/21.05.2019.

Only one candidate has applied for participation in this competition: Assoc. Prof. Dr. Todor Vasilev Gurov from the Department "High Performance Systems, Networks and Algorithms" (former name GTA), IICT-BAS.

1. *Short CV of the candidate.*

Assoc. Prof. Gurov was born in 1961. In 1987 he obtained his MS degree in Mathematics from the Faculty of Mathematics and Mechanics of Sofia University "St. Cl. Ohridski ". After full-time doctoral studies at IICT-BAS under the supervision of Prof. Ivan Dimov defended his thesis entitled "Monte Carlo algorithms for some transport problems" and received a PhD degree in Computational Mathematics. Since 1993 he has been working at IICT-BAS as a mathematician, Assistant Professor and Associate Professor. He holds a two-year postdoctoral specialization in the Department of Computer and Information Science, Brooklyn College, City University of New York, USA. Since 2004 he is Associate Professor at IICT-BAS, and since 2014 - a Deputy Director of IICT-BAS.

2. *General presentation of the submitted materials*

The candidate Assoc. Prof. Todor Gurov participates in the competition with all the necessary documents in accordance with the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Rules for the implementation of this law, the Rules for the Acquisition of Academic Degrees and Occupation of Academic Positions at BAS, and the specific rules of IICT-BAS.

26 full-text scientific publications, visible in the SCOPUS and / or Web of Science databases, which have not been used in the doctoral dissertation and in the promotion for an

Associate Professor and have not been submitted to NACID, are presented for review. All of the articles are published in the period 2004-2018. The publications can be categorized as follows: 4 publications have an impact factor [1, 2, 3, 4], 18 have SJR [5 - 13, 16 - 18, 21 - 26] and 1 is a book chapter [19]. Two lists of citations (174 citations in total) are presented, all of them from the period 2004-2018, i.e., after acquiring the academic position of Associate Professor; 74 citations are visible in SCOPUS. The author's h-index in SCOPUS (without autocitations) is 4, but according to SONICS the author's index of Assoc. Prof. Gurov is 7. It is especially important to note that Assoc. Gurov is the coordinator of the Bulgarian team in 7 successfully completed European projects and in 4 national projects, and has provided evidence for participation in 7 other EC funded international projects and in 6 national projects. This is an excellent achievement. Below is a table with the minimal value of indicators for the academic position "Professor" in the professional field 4.5. Mathematics at IICT-BAS and the values of the indicators, achieved by Assoc. Prof. Gurov.

Table. Minimal value of indicators for the academic position "Professor" in the professional field 4.5 Mathematics in IICT-BAS, and indicators value of Assoc. Prof. Todor Gurov.

Group of indicators	Content	Required indicators for "Professor"	Indicators of Dr. Atanassov
A	Indicator 1 (PhD dissertation)	50	50
B	Indicators 3 and 4	100	178
C	Indicators 5-10	260	371
D	Indicators 11	140	444
E	Indicators 12-18	150	630
		Total: 700	1673

3. General characteristics of Dr. Gurov scientific and applied activities and contributions in the submitted for review materials

The applicant's scientific and applied activity is in the field of competition. The main scientific results of the applicant are related to the development and study of new Monte Carlo and quasi-Monte Carlo algorithms for approximate solving of multidimensional integrals and integral equations and their application for solving various practical problems. The proposed algorithms have been developed for implementation on state-of-the-art high-performance

systems, have been investigated for scalability, parallel and energy efficiency and show very good results.

The teaching activities of Assoc. Prof. Gurov include a university course in Monte Carlo Methods, part I and II, Master's Program in Applied Statistics, New Bulgarian University, 2009, and the course "Introduction to Parallel Calculations" at the Training Center of BAS. He was the scientific adviser of two PhD students (Vera Koleva-Efremova and Dobromir Georgiev), who were dismissed in 2019 with the right of defense.

From the materials presented, I would like to point out the software package SALUTE (Stochastic ALgorithms for Ultra-fast Transport in sEmiconductors) - Grid application to study the quantum relaxation effects of electron-phonon interactions in semiconductors or quantum wires. It was recognized as a flagship grid application not only in Bulgaria but also in the Southeastern Europe. SALUTE has been demonstrated in various European fora as an achievement for the SEE region. This software system integrates a variety of Monte Carlo, quasi-Monte Carlo and hybrid algorithms, software tools and services, as well as schemas for efficient implementation in Grid environment. In order to optimize performance, a service called JTS (Job Track Service) has been developed to synchronize the flow of jobs sent to one or different Grid clusters.

The main **contributions/achievements** in the presented materials for this review can be summarized as::

- New Monte Carlo and hybrid Monte Carlo algorithms for quantum transport simulations in semiconductors and quantum wires are developed [2, 5, 6, 8, 13, 17] and their high performance scalability has been investigated.
- Grid application SALUTE (Stochastic ALgorithms for Ultra-fast Transport in sEmiconductors) for solving quantum-kinetic equations has been developed and tested [7, 10, 12, 19].
- A Monte Carlo method for solving the rendering equation in Cook-Torrance model has been developed and studied. A Monte Carlo approach for density reconstruction based on insufficient data has been proposed and studied, [3, 18].
- The use of various generators of pseudorandom and quasi-random numbers in a number Monte Carlo and quasi-Monte Carlo algorithms for solving multidimensional integrals and integral equations with variance reduction are studied [9, 11, 14, 16]. Parallelization schemas for quasirandom generators are developed, [21].
- The scalability and energy efficiency on high performance systems of classes of Monte Carlo and quasi Monte Carlo algorithms have been investigated [1, 17, 21, 22, 24, 25, 26]. Here, I would like to point out the new metrics introduced to evaluate the energy

efficiency of algorithms on high-performance systems and the resulting estimates for quasi-Monte Carlo algorithms.

- Parallel quasi-Monte Carlo algorithms for matrix computations with optimized performance for Intel Xeon Phi accelerators have been developed. Parallel efficiency of algorithms for inverting large sparse matrices and solving systems of linear equations with large sparse matrices using MPI and OpenMP is investigated [24, 26].

4. *Цитирания*

The total number of citations presented by the candidate for the competition is 74, all of them visible in Scopus, and are from the post-habilitation period as an Associate Professor. These citations give the points included in the table of minimum requirements. The candidate has also submitted an additional list which includes another 100 citations, again from the period after acquiring the academic position of Associate Professor .

5. *Оценка на личния принос на кандидата*

All of the publications submitted for the competition are co-authored, but it is natural to work in teams in this area. The applicant's personal contribution is beyond doubt.

6. *Критични забележки и препоръки*

I have no critical remarks. My recommendation is to continue his work in the advanced topics in the area of Monte Carlo and quasi-Monte Carlo algorithms and applications.

7. *Лични впечатления*

Dr. Todor Gurov has been a colleague of mine since 1993. I have high regard for Dr. Gurov's personal and professional qualities – he is tolerant, scholarly, hard-working, non-conflict, and possesses good leadership skills. In that sense Assoc. Prof. Atanassov is a true scientist..

CONCLUSION

The documents and materials presented by Assoc. Prof. Dr. Todor Gurov meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Rules for the implementation of this law, the Regulations of BAS and the corresponding regulations of IICT-BAS. The results achieved by Assoc. Prof. Gurov are in full compliance, and by many indicators exceed the specific requirements of IICT-BAS for the academic position of "Professor".

After acquaintance with the materials and scientific works presented in the competition and analysis of their importance and their contributions, I am convinced of my positive

assessment and I strongly recommend to the Scientific Jury to submit a recommendation to the Scientific Council of IICT-BAS for the selection of Assoc. Prof. Todor Gurov in the academic position of "Professor" at IICT-BAS in the professional field 4.5 Mathematics, scientific specialty Mathematical Modelling and Application of Mathematics (Monte Carlo and quasi-Monte Carlo Algorithms and Applications").

16. 09.2019 г.   Рецензент:

/проф. А. Караиванова/