

Standpoint

of prof. Dr Kiril Ivanov Simov, ICT-BAS

for the materials submitted for participation in a competition for the academic position of 'professor' at ICT-BAS, Department of Scientific Computations with Laboratory on 3D Digitization and Microstructure Analysis professional field 4.5. Mathematics, subject Mathematical modeling and application of mathematics in 3D digitization and microstructural analysis

Competition Details

By order No. 40/09.02.2024 of the Director of the Institute of Information and Communication Technologies, BAS, I have been appointed as a member of the jury in the competition for the academic position of 'professor'.

In the competition for 'professor', announced in the State Gazette, no. 103 of 12.12.2023, associate professor Dr. Ivan Georgiev Georgiev is a candidate.

The set of materials submitted by the applicant includes all necessary documents for the procedure. Associate Professor Dr. Ivan Georgiev has fulfilled the minimum national requirements under Art. 2b, para. 2 and 3 of ZRASRB.

Applicant Data

The candidate's professional resume is very impressive. Associate Professor Dr. Georgiev graduated with a master's degree in "Mathematics" at the Faculty of Mathematics and Informatics of the "St. Kliment Ohridski" in 1999 and defended his doctorate in the subject "Computational Mathematics" in 2007. He worked as a mathematician and chief assistant at IMI-BAS from 2003 to 2014. Since 2015, he has been an associate professor at ICT-BAS, and since 2021 he has been the scientific secretary of BAS. He has participated in six national scientific projects and

five international ones. He also worked at the Johann Radon Institute for Computational and Applied Mathematics, Austrian Academy of Sciences, from 2008-2013 - 38 months. Associate prof. Georgiev is a co-author of more than 45 scientific publications in publications with SJR and impact factor, which have more than 100 citations.

I have known Dr. Ivan Georgiev since 2014, when he joined the team working on the project proposal "National interdisciplinary research e-infrastructure for resources and technologies for the Bulgarian linguistic and cultural heritage, integrated within the European infrastructures CLARIN and DARIAH (CLADA-BG)", as well as in its subsequent realization. Within the framework of CLaDA-BG, he has a leading role in the construction of the IT infrastructure of CLaDa-BG. He also leads the Laboratory of 3D digitization and microstructural analysis participating in the project. They are working on tasks for 3D scanning, modeling, visualization of cultural and historical artifacts, buildings and architectural structures. He is a member of the Management Board of CLaDA-BG.

Description of Scientific Works

The candidate participated in the procedure with 21 publications, of which 19 are included in Scopus, Web of Science and ACM Digital Library. A larger part of these publications are related to problems of the application of numerical methods for studying the characteristics of different types of materials with respect to their usage in areas of industrial applications. The other papers extend the scope of the reported research beyond industrial applications to areas such as ecology, medicine, new materials development, paleontology, artifact modeling, and others. Almost all articles have been published in journals and series. A list of 57 citations of these publications is presented.

Scientific and Application Contributions

Part of the methods developed and presented in the competition publications work on data obtained by X-ray Industrial Computed Tomography. The models of the considered materials at the microstructural level obtained in this way were examined with regard to their different characteristics at the macro level. One approach to study at the microstructural level is the segmentation of tomographic data for porous and composite materials. Methods for this task are presented in papers 2, 9, 10 and 22. The various methods developed in these papers have been applied to obtain effective macro-characteristics of composite materials based on microstructural models. These types of tasks require new solutions due to their high dimensionality, which reaches in some cases up to 200 million degrees of freedom.

Another topic of research is the numerical simulations of the fluid flow process in a porous medium, which are applied to the design and research of artificial wetlands used for the removal of domestic waste water pollutants.

The applicability of 3D printing and metallization in creating working models of a metal pyramidal antenna is presented in paper 15. The experiments were performed with different types of printing. They show the applicability of these technologies to construct models with better characteristics (in this case, weight) without having significant deviation in device parameters. In this way, prototypes of various devices can be made and tested very efficiently.

In papers 14 and 16, the methods of the 3D laser scanning and the X-ray Industrial Computed Tomography were applied to study bone specimens. In particular, paper 14 presents a study of the reliability of linear measurements taken on dry skulls and corresponding measurements on their 3D digital models. The

results showed that 96% of all digital measurements differed from direct measurements by less than 2mm, and in 67.6% of the cases they differed by less than 1mm. The conclusion is that the two measurement methods can be considered comparable. This result provides an opportunity for a wide application of measurements on 3D models on various types of objects. For example, in the field of preservation and research of cultural and historical heritage, very often the objects of research interest are located within a large area and it is not possible to observe, measure and compare them simultaneously. Also, many of the artifacts are fragile and subject to decay if frequently used in research directly. In such cases, 3D models will be indispensable as research objects instead of real artifacts.

Besides the concrete results from the research described in the submitted publications, the cooperation of the candidate with different teams on different topics, including with colleagues from abroad, also makes a very good impression

Conclusion

After getting acquainted with the materials and scientific works of the candidate submitted to the competition, as well as the analysis of their significance and contributions, I confidently give my positive assessment and recommend to the Scientific Jury to elect Associate Professor Ivan Georgiev to the academic position "Professor" in professional field 4.5. Mathematics, subject Mathematical Modeling and Application of Mathematics in 3D Digitization and Microstructural Analysis for the needs of the "Scientific Calculations with 3D Digitization and Microstructural Analysis Laboratory" Department of ICT-BAS.

09.04.2024 г.

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