# REVIEW

by Prof. Stanimir Nedyalkov Stoyanov, PhD
about the materials submitted for participation in the competition
for the academic position of 'Professor'
at the Sofia University "Kliment Ohridski"

higher education field 4. Natural sciences, Mathematics and Informatics,
professional direction 4.6 Informatics
and Computer Science (Software technologies - Data-intensive software platforms)

In the 'professor' application, announced in the State Gazette, issue 87 from 19.09. 2021 for the needs of the Faculty of Mathematics and Informatics, as a candidate participates Assoc. Prof. Desislava Georgieva Petrova-Antonova, PhD, from the Faculty of Mathematics and Informatics at Sofia University.

By order № РД-38-593 of 10.12.2021 of the Rector of SU I was appointed a member of the scientific jury in an application for the academic position of 'professor' at SU in the higher education field 4. Natural Sciences, Mathematics and Informatics, professional direction 4.6 Informatics and Computer Science (Software technologies - Data-intensive software platforms).

**1. General presentation of the received materials**

The only candidate in the announced application is Assoc. Prof. Desislava Georgieva Petrova-Antonova, PhD, from the Faculty of Mathematics and Informatics at Sofia University.

The set of materials presented by the candidate is in accordance with the Regulations for the development of the academic staff of the Sofia University and includes the following documents:

1. CV.
2. Diploma of higher education.
3. Diploma for "PhD" degree.
4. Document for scientific title or academic position.
5. Certificate of work experience in the specialty.
6. Documents proving the fulfillment of the requirements under art. 115, para. 1, item 2.
7. List of publications:
   - list of all publications;
   - list of the publications submitted for participation in the competition.
8. List of publications, conferences, projects and scientific manuals generated by the "Authors" system.
9. Information on a sample for fulfillment of the minimum national requirements for the respective scientific field and the additional requirements of Sofia University "St. Kliment Ohridski ".
10. Reference to the citations with a complete bibliographic description of the cited and citing

publications.

11. Information on the original scientific contributions with attached relevant evidence.
12. Information on the indicators under Art. 122, para. 2 with evidence.
13. Scientific papers submitted for participation in the competition.
14. Abstracts of peer-reviewed publications in Bulgarian and English.
15. Copy of the announcement in the State Gazette.

For the application, the candidate has submitted a total of 19 scientific papers, of which 2 in journals and 17 in conference proceedings. 1 publication is with IF, 12 with SJR, 9 are referenced in WoS, 19 are referenced in Scopus, 3 are referenced in IEEE Xplore Digital Library, 4 are referenced in ACM Digital Library, 6 are referenced in Springer. All publications are in English and co-authored. I accept for review the publications submitted for participation in the competition. I would like to note the very careful preparation of the materials for participation in the competition, which greatly facilitates the preparation of the review.

Documents for participation in a number of international and national research projects as a leader and participant are also presented.

**2. Brief biographical data of the candidate**

In 2000, Assoc. Prof. Dr. Desislava Petrova-Antonova graduated with a master's degree from the Technical University in Sofia. In 2007, she receives the PhD degree at the same university. From 2000 to 2009, she was successively assistant, senior assistant and chief assistant at the Technical University in Sofia. Since 2009 he has been a senior assistant and from 2012 to the present she is an associate professor at the FMI of Sofia University. Currently, Desislava is also the head of a research group at the Institute for Big Data for the Intelligent Society (GATE).

**3. General characteristics of the candidate's research activities**

As far as I can find in the candidate’s application, I see that in recent years it has significantly exceeded the norm. In the presented materials I did not find information about the disciplines which the candidate lectures. After earning the academic position of associate professor, the candidate supervised 39 successfully defended diploma theses. Desislava was also supervisor of one defended doctoral student and is supervising two part-time PhD students.

According to the presented materials, the candidate has a total of 99 scientific publications, of which 20 are in scientific journals, 79 in conference proceedings, 2 textbooks and 4 laboratory manuals. Most of the publications are referenced in prestigious scientific databases. The 19 publications presented for the competition summarize the results related to the design and development of data-intensive software platforms, which I consider to be all on the topic of the competition. Accepting the statements in the author's reference, I would summarize the candidate's contributions in groups, as presented below.

**Reference architectures of big data platforms.** The research results of this topic are summarized in one publication (№ 11). The publication proposes a reference modular 3-layer architecture of a big data platform (known as GATE Platform), which satisfies 11 basic requirements (defined in the article as well). The proposed architecture provides source-independent collection and pre-processing of structured, semi-structured and unstructured data that allows seamless expansion of data sources depending on the particular application. The individual components ensure complete life cycle of big data including the collection of disparate data from heterogeneous sources, storage, pre-processing, analysis and visualization.

**Data-intensive software platforms for smart cities.** The results of research on this topic are presented in the following publications (№№ 1, 3, 4, 5, 7, 9, 10, 12, 15). A technological framework for the development and visualization of 3D semantic models of a city is proposed. Following the open standard CityGML 2.0, the usability of the framework is demonstrated by two particular applications - semantic models of the Lozenets and Vazrazhdane regions. Furthermore, the publications in this group present a software platform for monitoring, collecting, aggregating and visual analysis of air quality data from various sources. The real-time platform exposes a flexible multi-layer architecture and is able to integrate data from three data sources. The third platform calculates indicators that could be used for assessment of smart cities. The three-layer architecture of the platform provides calculation of various indicators such as type, calculation formula, and domain. A comparative analysis of indicators identified in the scientific literature was performed. A high-level ontology is proposed to connect different data sets needed to calculate the evaluation indicators. Along with the three platforms, I would include in this group of results the methodological framework for digital transformation and assessment of the productivity of smart cities, based on the concept of "digital urban twin". In accordance with this concept, six phases are defined that connect the physical city with its digital replica.

**Healthcare data-intensive software platforms.** The publications in this group (№№ 2, 8) present results related to the application of the proposed platforms in medicine. An application is for the assessment of cognitive impairment in patients with multiple sclerosis. Detection of early cognitive impairment is essential and requires targeted neuropsychological research, which is currently on paper, time consuming and increasing the volume of medical documentation. The second application, based on the concept of 'digital patient-twin', is suitable for the collection, storage, pre-processing, analysis and visualization of data in the field of cognitive disorders. The five-layer architecture uses the Hadoop distributed file system HDFS.

**Educational data-intensive software platforms.** The publications in this group (№№ 6, 13, 16) propose analytical models based on data from the field of secondary education in Bulgaria, which are based on the Big Data Value Chain. The main goal of the models is to classify schools into groups based on students' performance in external assessment and state matriculation exams, the number of dropouts and repeat students, and the number of unexcused and excused absences. The proposed analytical

models and approaches are integrated into a single platform to support informed decision-making in education.

**IoT data-intensive software platforms.** The publications in this group (№№ 14, 17, 18, 19) summarize the results related to the use of platforms in IoT applications. A software prototype of a real-time monitoring platform and detection of high levels of carbon emissions from vehicles has been proposed. The prototype includes a hardware module that uses sensors to collect data such as air pressure and temperature and air-fuel mixture ratio. The data is sent for pre-processing to a web application in a cloud environment, where it is formatted, stored in a relational database and calculates the following parameters: mass of air consumed, mass of fuel consumed and mass of carbon emissions. An additional software module in the cloud environment analyzes the data in the database and detects vehicles that emit large amounts of carbon emissions or damage. An open framework has also been proposed for communication on various devices from the Internet of Things using various protocols. The framework provides services for processing the received data and for applying pre-defined rules for device management. Its main advantage is the easy scalability with additional modules supporting new communication and application protocols. The key to the integration of different devices into the platform is the abstract layer, through which the transparent integration of different devices is achieved.

In summary, I would like to emphasize that the publications present original and innovation results, with scientific and practical impact. Thus, for example, the 3D models satisfying CityGML standard are unique for Bulgaria. In this sense, I accept that the developed 3D models are an original contribution of the candidate.

I would like to emphasize that I am impressed by the consistency and logic of the research, the results of which are presented in the publications of the competition - first reference platforms, then more specific ones and finally their application to three important domains.

I believe that all submitted scientific papers are in the field of application. I think that the articles submitted for the competition, which have been published in renowned publications and materials of international conferences, make internationally recognizable the scientific activity of the candidate in the professional field of the competition. Confirmation of this statement of mine is also the invitations for participation of Assoc. Prof. Dr. Desislava Petrova-Antonova in the program committees of numerous authoritative international scientific conferences and for a reviewer in authoritative publications.

From the documents I see that a total of 142 citations have been noticed, of which 86 are in articles referenced and indexed in Scopus and Web of Science.

**4. Evaluation of the candidate's personal contribution**

From the documents submitted for participation in this application, I am convinced of the personal merit of the candidate in the contributions presented in the publications. I think that the publications, despite being co-authored, undoubtedly include a significant contribution from the candidate.

**5. Personal impressions**

I do not know Assoc. Prof. Desislava Petrova-Antonova, PhD, and I have no personal impressions of her research and teaching activities. From the presented materials I could conclude that the applicant is a responsible and thorough scientist and a successful participant in research projects.

**CONCLUSION**

The documents and materials applied by Assoc. Prof. Desislava Petrova-Antonova, PhD, meet all the requirements of the Law and the Regulations on the Development of Academic Staff in the Republic of Bulgaria and the relevant Regulations of the Sofia University "Kliment Ohridski". The applicant has submitted a sufficient number of scientific papers, apart from those used in the defense of her PhD thesis and her application for the position of an Assoc. Professor. The applicant demonstrates original scientific and applied contributions, which have enjoyed international recognition, and a representative part of them are published in conference proceedings and approved scientific journals. The applicant's theoretical results have practical applicability, as some of them are directly oriented to education. The scientific and teaching qualification of Assoc. Prof. Desislava Petrova-Antonova, PhD, is undoubted. The candidate's teaching and research achievements fully comply with the specific requirements of the Faculty of Mathematics and Informatics. After becoming acquainted with the materials and scientific works presented in the application and analyzing their significance and scientific, scientific-applied, and applied contributions, I find it reasonable to give my positive assessment and recommend to the Scientific Jury to propose to The Faculty Council of the Faculty of Mathematics and Informatics to elect Assoc. Prof. Desislava Georgieva Petrova-Antonova, PhD, for the academic position of 'Professor' at the Sofia University in professional direction 4.6 Informatics and Computer Science (Software technologies - Data-intensive software platforms).

07.02.2022

Reviewer:

(Prof. Stanimir Stoyanov)