

OPINION

by Prof. Elissaveta Dimitrova Gadjeva – Member of a Scientific Jury

in a competition for the academic position Professor in the professional field

5.2. “Electrical Engineering, Electronics and Automation”, scientific subject 02.21.07
“Automated systems for information processing and management”, published in the State Gazette,
№ 57/09.07.2021 for the needs of the section "Information technologies for sensor data processing",
Institute of Information and Communication Technologies - BAS

Candidate: Assoc. Prof. Kiril Metodiev Alexiev, PhD

I. Summary of the scientific activity and achievements of the candidate

The only candidate in the competition - Assoc. Prof. Dr. Kiril Metodiev Alexiev is a long-term researcher in the section of Information Technologies for Sensor Data Processing, Institute of Information and Communication Technologies - BAS. He has a total work experience of 39 years, of which 16 as an associate professor.

To participate in the competition, the candidate has submitted for review a total of 48 scientific papers, of which:

- 12 publications, equivalent to habilitation work, published in journals and issues, referenced and indexed in world-famous information databases (Scopus, Web of Science) (Group B publications). Complete bibliographic data and internet links for confirmation are presented.
- 14 scientific publications, published in journals and issues, referenced and indexed in world-famous information databases.
- 13 publications published in unrefereed journals and issues with scientific peer-review.
- 22 publications, published in unrefereed scientific journals, mostly published in Bulgaria, but subject to successful scientific review.

17 of the publications are referenced in SCOPUS, 15 are referenced in WoS (Scopus, Web of Science), 3 are referenced in MathSciNet, one article is referenced in PACIS (the South American equivalent of WoS), and 14 publications are referred to NACID.

According to the number of authors, the peer-reviewed papers are distributed as follows: The candidate is the sole author of 7 publications. In 15 publications the candidate is the first author. In 12 - second and in 5 - third co-author.

According to the place of publication: in the prestigious journals “Cybernetics and Information Technologies”, “Advanced Computing in Industrial Mathematics”, in “Studies in Computational Intelligence”, in “Lecture Notes in Computer Science”, in “Special Issue of CIT”, in “Cybernetics and Information Technologies”, in “Journal of Computational Interdisciplinary Sciences”, in “Information Technologies and Control Journal”, in “Automation and Informatics”, in “Modeling and optimization of transport networks”, etc.

Assoc. Prof. Alexiev participated in writing 3 chapters of books: "NATO Science for Peace and Security Series", Subseries "NATO Science for Peace and Security", Series B: Physics and Biophysics, ed. Springer; “NATO Science for Peace and Security Series”, ed. IOS Press; NATO ASI “Advances and Challenges in Multisensor Data and Information Processing”, ed. IOS Press.

Two of the articles were published as white papers, one through PRACE (Partnership for Advanced Computing in Europe) and one through VLADA (Virtual Lab for Advanced Data Analysis).

Data on 208 citations from 32 publications are given. 7 of the publications are in Bulgarian and 41 publications are in English.

All scientific papers are used only for this competition and are in the field of the competition.

Data for participation in 25 scientific or educational projects are presented. He is a leader of 6 of them. 8 of the projects are international.

The achieved results in the implementation of the main indicators for area 5. "Technical sciences" are: for indicator A: 50 points with a minimum number of 50 points, for indicator B: 322 points with a minimum number of 100 points, for indicator Г: 429 points with a minimum number of 220 points, for indicator Д: 2059 points with a minimum number of 120 points, for indicator E: 430 points with a minimum number of 150 points. It can be seen that the requirements are fully met and that the points scored by the candidate significantly exceed the minimum number of points required to hold this academic position.

As a highly erudite specialist in the field of information technologies for signal and image processing, Assoc. Prof. Dr. Alexiev successfully participates in the educational process at Sofia University, Technical University of Sofia, Technical University of Gabrovo and the Higher School of Telecommunications and Post - Sofia.

II. Main contributions in the scientific and scientific-applied activity of the candidate

1. Scientific contributions

- A new approach to decomposition of a one-dimensional signal based on self-similarity has been proposed [2,8]. Decomposition does not depend on the scale of the signal both in amplitude and time. It gives an idea of both the time and frequency properties of the signal.
- A new signal coding algorithm has been proposed that allows the storage of its most important characteristics in a compact form [3].
- A new algorithm for simplified estimation of the nonlinearity of digital signals is proposed, which allows the designers to make the right choice of processing algorithms.
- An approach for detection of non-stationary Wiener signal in the presence of non-stationary Wiener noise in the channel by the method of maximum likelihood has been proposed [24].
- An approach has been proposed for the detection of point underground objects on the reflected radar signals in the development of a radar for underground drilling [40].
- A method has been proposed for combining normal ultrasound images with Doppler images in order to detect lesions in the prostate with abundant blood flow [33].
- Methods have been proposed for 3D visualization of the activity of neurons in a segment of the cerebral cortex containing several thousand neurons [38], as well as for visualization of 3D surfaces described by polysplines [48].
- A method was proposed in [6] to increase the accuracy of a mobile eyetracker. For this purpose, the built-in inertial sensors are used - accelerometers and gyroscopes, together with the pupil monitoring device.
- An approach for dynamic evaluation of the camera parameters (calibration) by selected fixed points in two or more images is proposed. In [45], an original approach was proposed for finding the correspondences of specific points of images obtained from a rotating camera. An algorithm for restoring 3D reality on two or three images of a still camera with evaluation of the blurring of the contours of objects due to inaccurate focusing has been proposed [39,41].
- An approach has been proposed to combine the measurements obtained from gyroscopes and accelerometers through the use of fuzzy logic, in order to increase the reliability in determining the forces acting on the body [12].

2. Scientific-applied contributions

- The proposed approach for the decomposition of a one-dimensional signal has been applied to recover telemetry information received from satellites [5]. In [1] signal decomposition is applied to ECG signal processing.
- A built-in system of edge detection filters, directional filters [23] and a neural network [23,31] for automatic detection of elements in the processing of satellite multispectral images is also proposed.
- A scheme for forming a beam of an acoustic grating with a lower level of the side sheets and software for providing an acoustic map of an antenna array, which illustrates the spatial propagation of the sheets, is proposed [25].

- An ultrasound imaging system has been proposed to help detect prostate cancer.
- A system for detection and recognition of faces with parallel implementation of algorithms is proposed [34].
- An algorithm for non-destructive testing of roller and ball bearings is proposed based on the combined information of 18 microphones and one camera [9].

3. Applied contributions

- A mobile application for counting calories burned has been developed using inertial sensors built into mobile phones [16, 17].
- A simulator of signals from inertial sensors, accelerometers and gyroscopes has been proposed [28].
- A transport model has been built on Tsarigradsko Shosse Blvd. and the area around it in its part from Sofia University to the 7th kilometer to optimize traffic in this section by maintaining maximum traffic capacity and minimizing the emitted emissions and noise [11, 13].
- A review of four methods for superresolution (increasing the resolution), along with experimental results for their implementation in the presence of noise and incorrect image recording.

III. Significance of contributions to science and practice

The significance of Assoc. Prof. Dr. Alexiev's contributions to science and practice is indisputable. This is confirmed by the large number of citations of his scientific works and is a testament to the recognition of the candidate among the scientific community in Bulgaria and abroad. His scientific works have been published in prestigious international journals and books by publishers such as Springer and IOS Press. The many research projects in which he participates as a member or leader are proof that he is a sought-after and highly valued researcher, able to solve a variety of current and significant practical problems.

The quantitative indicators for holding the academic position of "professor" are greatly exceeded.

IV. Critical remarks and recommendations

I have no significant critical remarks on the submitted materials for participation in the competition and on the significance of the scientific works of the candidate. My wish is to continue in the future with the same enthusiasm and dedication in his work his research work in the field of modern technologies for signal and image processing in the team led by him.

V. Personal impressions and opinion of the reviewer

I have known Assoc. Prof. Dr. Alexiev since 1985 from our joint work at the Institute of Special Electronics and at CCIIT - BAS. I believe that the qualities he possesses - scientific integrity and demanding of himself, contributed to his growth as a highly qualified scientist.

CONCLUSION

Based on the presented scientific papers and the scientific, scientific-applied and applied contributions contained in them, the fulfilled and exceeded minimum national requirements, the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, I consider it reasonable to propose Assoc. Prof. Dr. Kiril Metodiev Alexiev to take the academic position "Professor" in IICT-BAS, section "Information technologies for sensor data processing", in professional field 5.2 "Electrical engineering, electronics and automation", specialty: "Automated systems for information processing and control".

October 30, 2021

Member of the Scientific Jury:

(Prof. Dr. Eng. Elissaveta D. Gadjeva)

