

REVIEW

in a competition for the academic position “**Professor**”,
professional field 5.2. “Electrical engineering, electronics and automation”,
specialty 02.21.07 “Automated information processing and management systems “.
announced in SG no. 57 from JULY 09, 2021
with the candidate: Kiril Metodiev Alexiev, Dr, Associated Professor
Reviewer: Ognian Lubenov Boumbarov, Dr, Professor

1. General provisions and biographical data

Brief biographical data. The candidate in the announced competition for the Academic Position “Professor” was born on December 16, 1957. He completed his higher education at the Kyiv Polytechnic Institute, specializing in Automated Control Systems, in 1984. He enrolled in a full-time doctorate at the Institute of Parallel Information Processing in a doctoral program in Radar and Radionavigation in 1994. In 1997 he received the educational and scientific degree of Doctor of Radar and Radio Navigation. He began his professional career as a designer and then a researcher II degree at the Sofia Institute of Special Electronics. His professional growth passes through the positions of Assoc. I st., St. N.s. II st. And the head of a section at the Coordination Center for Informatics and Computer Science, BAS (1989 to 2005). After reorganization, the Coordination Center for Informatics and Computer Engineering was administratively transformed into the Central Laboratory for Parallel Information Processing and then the Institute of Information and Communication Technologies - BAS (IICT-BAS). In 2005, already at IICT - BAS, the candidate was elected head of the section “Information Technologies for Sensory Data Processing” and held this position until the announcement of this competition. In the same year, the Higher Attestation Commission at the Council of Ministers of the Republic of Bulgaria awarded him the scientific title of Senior Research Fellow II degree (Associate Professor).

2. General description of submitted materials.

To participate in the competition for the academic position of “professor”, the candidate has submitted for review: - a total of 48 scientific papers, - a list of 25 research projects and developments, as well as proof of 1 copyright certificate, all related to the competition. All scientific papers (submitted by the Assoc. Prof. Kiril Alexiev) have not been used in the competition for the academic position of “Associate Professor”. The candidate is the author of 7 independent scientific papers (2 participations in conferences, 4 in magazines and one chapter of a book) and 41 scientific papers in co-authorship. In the co-authored works, he is first in 15, second - in 12 and third in 5. I believe that the individual works of the candidate are his personal work, and the other co-authored works are developed and presented with his active participation. The publications are characterized by conscientious citation of literary sources, and no borrowing from other authors has been noticed. The attached “List of citations of Kiril Alexiev” contains data on 32 scientific papers for the period (1998-2017) with evidence of 208 citations, and only in the period (1998-2000) for 2 publications, the citations are 28. The attached reference includes publications in English and Bulgarian, which will naturally limit the number of citations in the known databases Scopus and Web of Science by years and conditions for indexing.

The reference made in the scientific databases Scopus and/or Web of Science for the indexation of the published scientific works of Assoc. Prof. Kiril Alexiev for the period (1998-2020) shows that:

- in the scientific database - 30 publications with 24 co-authors are indexed, and 105 citations at h-index 7 are noticed;
- in the scientific database "WoS" - 26 publications with 52 citations at h-index 5; 13 of them used in the competition were not found in Scopus.

In the current competition, Assoc. Prof. Alexiev uses 18 publications indexed in Scopus, which have 32 citations found. Thus, the total number of non-overlapping citations in the two databases is 45; 3 of the papers were published in journals with IF, and 6 scientific papers were presented in international conferences with SJR.

The summary report shows that out of 48 publications submitted for participation in the competition, 18 publications with a total of 45 citations were indexed in the Scopus and/or Web of Science databases, and 163 citations were found in other databases for published 30 scientific papers. Moreover, the high h-indices in Scopus and Web of Science confirm the quality of published scientific papers.

The research contracts are divided into the following categories: research contracts financed by the Research Fund - 4 pieces; contracts for the purpose of student training - 2 pieces; Erasmus program - 3 pieces; internal research contracts of IICT - 4 pieces; international agreements "Cost" - 3 pieces; contracts for applied research with other departments and companies - 5 pieces; and 2 contracts granted by the National Innovation Fund. Two additional contracts are presented: - a civil contract and -- a contract for a supplementary agreement to the main employment contract with IICT, but they do not participate in the evaluation of the candidate.

The summarized data on the volume and quality of the scientific works and the research contracts prove that the Assoc. Prof. Kiril Alexiev is a graduate scientist and researcher.

3. General characteristics of the research and scientific applied activity of the candidate.

The presented documents and references, as well as the claims for the availability of scientific, scientific-applied and applied contributions are presented quite precisely and systematically, in accordance with ZRAS and PPZRAS. This greatly simplifies the work of the reviewer for data compliance.

In the presented document "REFERENCE for the fulfillment of the minimum requirements of IICT for the academic position of professor", Assoc. Prof. Dr Kiril Alexiev has systematized the scientific papers and contracts in a reference to the minimum requirements for candidates to hold this academic position in several groups of indicators. In order to comply with the requirement for the availability of a protected habilitation thesis, the applicant has proposed to divide the submitted publications into groups B and G in order to protect the required number of points.

Group A indicator. According to the requirement the candidate has submitted a copy of the Diploma for awarding scientific and educational degree "Doctor" on "Using Hoch's transformation to detect trajectories in radar information processing" from the doctoral program of the Institute of Parallel Information Processing . Thus, the candidate fully satisfies the requirement of this indicator.

Group B indicator. To fulfill the requirement to collect 100 points by submitting a habilitation thesis or the availability of scientific publications (not less than 10) in editions referenced and

indexed in world-renowned databases, the applicant has submitted a list of 12 publications and evidence of fulfillment of the above condition according to the requirements. The publications are in the journal with SJR "Cybernetics and Information Technologies", the journal "Comptes Rendus de L'Academie Bulgare des Sciences", the specialized and quite popular editions and collections of the publishing house "Springer": Lecture Notes in Computer Science, Nature Switzerland and Studies in Computational Intelligence, as well as Proceedings of SPIE - The International Society for Optical Engineering, the international scientific conference "CompSysTech" - Bulgaria and the IEEE International Symposium on INnovations in Intelligent SysTems and Applications-INISTA-Romania. Complete bibliographic evidences and internet links for verification are available.

I accept that the candidate has correctly calculated a total of over 300 points, and this result significantly exceeds the minimum requirement of 100 points for this indicator.

Group G indicator. A requirement to collect a minimum of 220 points exists.

To meet the minimum requirements of this indicator, the applicant has used the remaining 36 publications from the general list, divided into two subgroups G7 and G8.

The G7 subgroup contains 14 scientific papers published in publications that are referenced and indexed in world-famous databases of scientific information. These are specialized publications in proceedings of scientific conferences, mainly published by the IEEE, Springer and others. (IEEE International Symposium on INnovations in Intelligent SysTems and Applications, INISTA-Turkey, Bulgaria, Italy, Spain; CompSysTech-Bulgaria; IEEE 8th International Conference on Intelligent Systems - Bulgaria; International Conference "Modeling and Development of Intelligent Systems" - Romania).

The other subgroup G8 of this indicator contains the remaining 22 publications published in non-refereed scientific journals, mainly published in Bulgaria, but subject to a successful scientific review (Automation and Informatics, Acoustics, Information technology and Control) and international scientific conferences held in Bulgaria (Telecommunications, Informatics, Energy, Safety management, Automatics and Informatics, Space, Ecology, Safety, National congress of Bulgarian society for physiological sciences).

The presented complete bibliographic data allow to easily find a correspondence between the result calculated by the candidate more than 400 points and the result obtained after the review by the reviewer.

At the discretion of the reviewer, the publications submitted for participation in the competition in terms of volume and quality meet the requirements of indicator G.

Group D indicator. According to the requirements, the protection of this indicator is based on citations found in scientific databases, as the quantitative dimension is at least 120 points. A full analysis of the citations was made in section 2 of this review and the reviewer can confirm with full confidence the result obtained by the candidate in the presence of 208 citations, with which the candidate collects over 2000 points and significantly exceeds the minimum of Indicator D.

Group E indicator. The requirements for this indicator are for received 150 points. From the large number of subgroups of this indicator, the candidate has collected over 400 points in fulfilling the conditions of subgroups from E18 to E21 and E26. Here the candidate's participation in research projects is important. The analysis made in section 2 convinces the reviewer that the candidate has correctly calculated the overall result, thus fulfilling the conditions of this indicator.

Conclusion: The reviewer's convinced opinion is that the candidate fulfills and significantly exceeds in all respects the minimum national requirements of ZRAS, PPZRAS and the requirements of IICT for the academic position of "Professor".

4. Assessment of the pedagogical preparation and activity of the candidate.

Since 2005, the candidate Assoc. Prof. Dr. Kiril Alexiev has held the position of Head of the Information Technologies for Sensor Data Processing Section at IICT-BAS. This circumstance determines its main job function: leadership and participation in research projects. The accumulated experience and knowledge in addition has allowed him to participate in the learning process in several universities: Sofia University, TU-Sofia, TU-Gabrovo and the Higher School of Telecommunications and Posts-Sofia mainly in the field of information technology (signal processing and images) and a course in Industrial Mathematics at Sofia University.

The reviewer knows the quality of his academic work at TU-Sofia and the Higher School of Telecommunications and Posts-Sofia and defines it as very good.

5. Main scientific and applied-scientific contributions

The more significant contributions can be grouped as:

I. Scientific contributions

1. A new decomposition of a one-dimensional signal based on self-similarity without pre-selection on an orthogonal basis is proposed [2, 8]. Decomposition does not depend on the scale of the signal both in amplitude and time.
2. A new approach for signal coding is proposed, preserving the most important characteristics of the signal in a compact form [3].
3. A new approach is proposed for estimating the nonlinearity of one signal, system or dependence of one signal on another [4].
4. A block diagram and a rule for detecting a non-stationary Wiener signal in the presence of non-stationary Wiener noise in the channel by the maximum likelihood method are proposed [24].
5. A method has been developed for detecting point underground targets in images obtained by underground drilling radar based on the Hough transformation [40].
6. A method is proposed for combining normal ultrasound images with Doppler ones in order to detect lesions in the prostate with abundant blood flow (prostate cancer) [33].
7. An approach for restoring 3D scenes based on several obtained images has been developed. The problem of dynamic estimation of the camera parameters is solved, a method for finding correspondences of specific points of images obtained from a rotating camera is proposed, an approach for estimating the depth of the scene based on the blurring of the contours of objects due to inaccurate focusing [39, 41, 42, 45].
8. Methods for 3D visualization of the activity of neurons in a segment of the cerebral cortex containing several thousand neurons and of visualization of 3D surfaces described with polysplanes are proposed [38, 48].

II. Scientific – applied contributions

1. An algorithm has been proposed to increase the accuracy of eyetracker using data from accelerometers and gyroscopes [6].
2. An algorithm for non-destructive testing of roller and ball bearings based on the combined information of 18 microphones and one camera is proposed [9].
3. A scheme for forming a beam of an acoustic grating with a lower level of the side sheets [25] and software for obtaining an acoustic map of an antenna grating, which illustrates the spatial propagation of the sheets [25], is proposed.

4. An analysis of the encryption properties of the newly proposed IDA algorithm (of the DES class) is made [10].
5. An algorithm has been developed to recover telemetry information received from satellites by storing the texture of the damaged / lost signal [5].
6. An algorithm for detecting irregular pulse in ECG signals has been developed [1].
7. A parallel algorithmic implementation of a system for detection and recognition of faces (using supercomputers) is proposed [34].
8. A comparative analysis of four super resolution methods [46] and four main methods used in inertial navigation [7, 27].
9. A scheme for reducing the uncertainty of the covariance matrices in the Kalman filter and specifying their parameters using a system of fuzzy rules and ESN network is proposed [15, 19].

III. Applied contributions

1. 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 for traffic optimization in this section and assessment of noise and CO2 pollution [11, 13].
2. A signal simulator from inertial sensors has been proposed [28].
3. A mobile application has been developed for recording calories consumed using inertial sensors built into mobile phones [16, 17].
4. Software packages have been developed: for detection of point objects in images of underground drilling radar (contract IF-02-85) and for software stabilization of a smartphone camera using inertial sensors (projects BG161PO003-1.1.06-0037- C0001 and BG161PO003-1.1.06-0038-C0001).
5. A system for statistical analysis of automatic tagging of photographs has been developed (project BG16RFOP002-1.005-0163).
6. Software packages for detecting linear elements in satellite multispectral images using filters and neural networks [23, 31], a software package for processing ultrasound images to assist in the detection of prostate cancer [33] and an evaluation package have been developed. of the perception of visual information working in complex with eye tracker [32].

6. Significance of contributions to science and practice

In the great variety of solved scientific and scientific-applied problems, each work of the candidate is important in his development as a specialist. On the other hand, there is a significant application orientation and a certain benefit for the society. The proposed new methods and approaches in the field of processing of one-dimensional and multidimensional signals, processing and analysis of data from multiple sensors (video cameras, microphone arrays, radars, accelerometers and gyroscopes) and software simulated algorithms solve important practical problems in medicine, biometric technologies, forensics, acoustics, navigation, etc.

In connection with the detailed analysis made in section 3, I note again that the quantitative indicators for holding the academic position of "professor" are largely exceeded.

7. Critical remarks and recommendations

After the in-depth analysis of the research and applied activity of the candidate, I have no significant critical remarks on the materials of the competition and on the significance of his scientific works. However, a general conclusion can be drawn, his activity extends to a very wide scientific field. It is necessary, in the future, to limit his scientific interests and activities in one or two current scientific fields. With the experience and knowledge gathered to actively work with

PhD students and build a team for future projects with national and European funding in his capacity as a leader.

8. Personal impressions and opinion of the reviewer

I know the candidate from our joint study work at TU-Sofia and the Higher School of Telecommunications and Post-Sofia. He is a prominent specialist in the field of “processing of one-dimensional and multidimensional signals”. Almost all of his participations in projects and research have a real practical orientation and solve important issues for practice. With this in mind, I declare that my impressions of the candidate are excellent.

CONCLUSION

Based on the analysis of the presented scientific papers, their significance, the scientific-applied and applied contributions contained in them, I find it reasonable to propose the candidate Assoc. Prof. Dr. Kiril Metodiev Alexiev to take the academic position of “professor” at 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”.

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(Prof. Dr. Ognian Boumbarov)