

REVIEW

For a procedure for an academic position „Associated Professor”,
State Newspaper, No 45/28.05. 2021

Candidate: **Chief Assistant PhD Vladimir Nikolaev Ivanov**

By Krasimira Stoilova, DSc – Institute of Information and
Communication Technologies – Bulgarian Academy of Sciences
(IICT – BAS)

I am nominated as a member of the Scientific Jury according to Order № 178 from 16.07.2021 by the Director of IICT – BAS, on the base of solution of the Scientific Council of IICT-BAS about procedure for the academic position “Associate professor” in the scientific domain “Technical Sciences”, professional field 5.3.”Communication and Computer Technique”, scientific specialty “Communication Networks and Systems” for the needs of “Distributed Information and Control Systems” department of IICT – BAS. Only one candidate – assistant professor PhD Vladimir Nikolaev Ivanov has submitted documents.

1. Short CV

Assistant Professor Vl. Ivanov is an engineer, graduated in UCTM- Sofia in 2008. During 2011-2014 he is a PhD student in IICT – BAS. He has defended a thesis on the topic “Development of software for modeling multifunctional electronic circuits”. He is a PhD and chief assistant from 2015.

2. General description of the presented documents

According to the official notice about total work experience which is 11 years, 6 years and 7 months he is working like chief assistant in IICT - BAS.

Vl. Ivanov has submitted 24 publications for the competition and all of them are after the defense of his thesis. He has 13 individual publications [B3.1, Г7.1, Г7.4, Г8.2, Г8.3, Г8.5, Г8.6, Г8.8, Г8.10, Г8.11, Г8.13, Г8.15, Г8.16]. The list of his all publications contains 35 scientific publications.

The scientific interests of Chief assistant Vl. Ivanov are in two main domains according to his publications:

- Processing of large streams of information in real time;
- Intelligent systems for traffic control systems.

The design of systems for large streams of information in real time has a modern solution based on the usage of FPGA (Field Programmable Gate Array). The systems, realized by this class devices can be modified, can have different measurements and structures. That is why they are more perspective for the market position. The main advantage of the usage of the FPGA is that they allow realization of several embedded processors in the frame of one chip. These processors do not need synchronization, they can combine memory and other hardware-implemented elements, which in practice allow practical application of the latest achievements in the field of information technologies. The application of this class devices allows realization of parallel computational procedures. This leads to more effective use in comparison with the specialized processors for large streams information processing.

The usage of FPGA for the realization of controller for the traffic light control of city traffic leads to minimization of financial expenses, necessary for its design and to decrease of its cost.

Generalization of the results of the scientific researches of V.I. Ivanov is done in the monograph "Management of transportation systems and processes". The monograph contains 4 chapters. In *First chapter* are presented the main parameters and models, applied in the control of transportation systems. Criteria and formal models for optimal control are defined. In *Second chapter* are discussed problems for measurements of parameters of the traffic intensity in a transport area. The tools for image processing which allow identification of the vehicles are presented. In *Third chapter* analytical presentation of technical devices which have application for the design of devices for monitoring and analysis of transport parameters with a declared interest in programmable matrices is done. Funds for their design are presented. The author makes a choice to these complicated technical components because of their high functionality, which can solve problems on identification of parameters of the dynamics of transport systems in real time. *Fourth chapter* contains results from experiments of control and simulation of transportation systems. Technical solutions which have applications in the development of devices about identification and measurement of transport parameters are presented. The benefit of the designed devices is illustrated by diagrams and appreciations of their functioning.

Results of the joint application of the designed devices and simulation software environments for comparison and settings of the technical devices for the measurement of the transportation dynamics are presented.

The results in the monograph are related with the control of transportation systems and development of technical devices, necessary for monitoring and measurement of the state of the transportation dynamics. The monograph reflects the professionalism and very good qualification of the author in developing devices applied for the identification and measurement of the dynamical parameters of transportation systems.

3. Analysis of the scientific and applied contributions

From the presented for the procedure 24 publications I do not referee three of them ($\Gamma 7.3$, $\Gamma 8.7$ and $\Gamma 8.9$), in which I am co-author.

I appreciate the contributions of the presented publications like scientific-applied and applied in two main directions:

- **Analysis and synthesis of appropriate approaches and algorithms for data and signal processing for the management of transportation systems/urban traffic and other applications:**
 - The structure, properties and possibilities of digital devices for signal processing DSP48A1, DSP48E1 and DSP48E2, embedded in the modern series FPGA of Xilinx are analyzed [$\Gamma 8.13$].
 - Structures of FPGA devices and their application for the development of specialized computational complexes are analyzed [$\Gamma 8.15$].
 - Comparative analysis of devices for prototype research on FPGA based products and systems is done [$\Gamma 8.10$].
 - An approach for signal processing with the use of FPGA for calculation of jumping average or smoothing data [$\Gamma 7.2$] and PID regulator [$\Gamma 7.4$], based on the module for digital signal processing DSP48A1, embedded in the structure of FPGA of the series

Spartan 6 of Xilinx is presented. The advantages of this approach for realization in comparison with the approaches based on the classical logic, specialized and embedded processors are argued.

- Optimization of the size of the averaging jumping window, used for the processing of signal of pulsar, realized on the base of FPGA device is done [Г8.14]. The goal is increase of the relation signal/noise and saving the useful signal information without violating of Nyquist theorem when changing the sampling frequency. The setting and testing of the filter parameters is performed with a real pulsar signal B0329 + 54.
- The received results show that the synthesized algorithm in [Г7.7] can be successfully applied for signal detection of pulsar. By using a "jumping average filter" in the time domain, the signal is increased to a noise ratio and the detection time is reduced [Г8.12]. A formal relation for a choice of the size of the "jumping average window" is proposed.
- Intelligent system for traffic lights control is designed realized on the base of pre-programmable microprocessor PicoBlaze, embedded in Spartan6 FPGA structure in crossroad traffic [Г7.1, Г8.6]. It is justified the choice of PicoBlaze because it requires less resources in comparison with other embedded microprocessors. The architecture of PicoBlaze allows full access to all hardware chips' elements and allows parallel execution of algorithms in the frames of one FPGA device.
- The possibilities of specialized environment for work with reprogrammable devices with a goal improving the process of mastering the taught material by illustrating the theoretical and practical side of the learning process are presented [Г8.5]. Xilinx CPLD devices can be considered as the first step in the process of mastering the modern reprogrammable devices. In order to simplify the process of generating embedded PicoBlaze systems, a methodology has been developed, including a program for automatic generation of systems of this type. The program is of the type WUDISWUG (What yoU Draw IS What yoU Get).
- **Synthesis of intelligent systems for traffic control**
 - An intelligent urban traffic management system with video information processing has been synthesized [Г7.5]. An algorithm for processing video information obtained from traffic monitoring for the purpose of automatic detection of moving objects and evaluation of individual basic parameters with an accuracy of over 90% has been synthesized, which can be used in an automated urban traffic management system [Г7.5]. The algorithm recognizes vehicles passing through an intersection and evaluates their size, speed and direction of movement. As no large computational resources are required, the algorithm is applicable for real-time control.
 - An algorithm for recognizing vehicles in motion has been synthesized. Urban traffic is modeled in AIMSUN software environment with application of the TRANSYT optimization package for a specific network of intersections [Г7.6]. As a result of the optimization in order to minimize the stops of the traffic flow, the settings of the traffic lights in the considered network have been changed.
 - A system for monitoring the density of urban traffic passing through an intersection has been implemented [Г8.4, Г8.8].

- Methods and means for measuring the characteristics of the transport traffic are analyzed with a conclusion made, preferably of sensors for visual information [Г8.11].
- An analysis of space transport in terms of types of space transport, space logistics, proposed global solutions to improve the ecology of outer space, space navigation, and space tourism [Г8.16].

I appreciate positively the theoretical and application contributions in the both presented scientific domains of the candidate.

4. Citations

The noticed citations of the presented in the procedure publications are 12 and 10 of the citations are indexed and referee in Scopus and Web of Science publications.

5. Implementation of the minimal requirements and other activities

Chief assistant Ivanov satisfies and exceeds on nearly all criteria the minimal national requirements for the academic position "Associated Professor". His total number of points is almost twice the minimum of 450 points required for the position - 808.33 points.

I report inaccuracies admitted by the candidate in the Information attached to him for fulfillment of the minimum requirements, presented in the table below. Despite the inaccuracies, he significantly exceeds the minimum required for the position.

Indicator's code	Indicator	Minimum	Presented by the candidate	Reviewer
A	Dissertation for PhD	50	50	50
B	B3 or B4	Min 100	100	100
B3	Habitat work - monograph	100	100	100
B4	Habitat work - publications, indexed in world-famous databases	60/n for each publication		
Г	Sum of Indicators 5 to 11	220	423.33	433.33
Г7	Scientific publications in editions that are indexed in world-famous databases	40/n	173.33	173.33
Г8	Scientific publications in non-peer-reviewed peer-reviewed journals or in edited collective volumes	20/n	250	260
Д	Sum of indicators 12 to 15	60	370	120
Д12	Citation in scientific journals, referenced and indexed in world-famous databases of scientific information, or in monographs and collective volumes	10	110	110
Д14	Citation or reviews in non-peer-reviewed journals with scientific review	2	10	10
Е	Sum of indicators from 16 to the end	20	105	105
Е18	Participation in a national scientific or educational project	10	40	40
Е19	Participation in an international scientific or educational project	20	20	20
Е20	Management of a national scientific or educational project	20	40	40
Е22	Raised funds for projects managed by the applicant	1 point for 5000 lv.	5	5
Total number of points		450	1048.33	808.33

The total number of his scientific publications is 35. His H-index in Scopus is 3.

Chief assistant PhD VI. Ivanov has an active project activity. He is a leader of two youth projects: with National Scientific Fund and Bulgarian Academy of Sciences. He participates in one international project (ACOMIN – international project of 7th Framework Program of EC) and 4 national projects.

Chief assistant PhD VI. Ivanov has an active scientific and applied activity characterizing him as a young scientist with great potential.

6. Critical remarks and recommendations

I have no significant remarks to the candidate. I noticed some technical inaccuracies:

- The list of publications has an arrangement which does not correspond to the numbering of publications in the full text with regard to Г7.5 and Г7.7. I used the numbering from the List of publications above.
- Reports from other authors are unnecessarily included in the full text of publication Г8.5.

I know Chief Assistant Professor Dr. Vladimir Ivanov as a persistent and successful researcher with proven professional success. My recommendation is to continue and deepen his research, the results of which to publish in prestigious publications.

Conclusion: On the base of the presented documents, scientific and applied contributions, and on the base of the complex appreciation of the other criteria of the procedure, I give my **positive opinion** and **strongly recommend** to the honorable Scientific Jury to propose to the Scientific Council of ICT-BAS to award to assoc. Prof. Vladimir Ivanov the academic position “Associate Professor” for the needs of “Distributed Information and Control Systems” department, professional field 5.3.”Communication and Computer Technique”, specialty “Communication Networks and Systems”.

10.09.2021

NOT FOR PUBLIC RELEASE

K. Stoilova, DSc