

REVIEW

Concerning scientific papers and works submitted for participation in competition for the academic position of “Associate Professor” in professional field 5.3. “Communication and Computer Engineering”, scientific specialty “Communication Networks and Systems”, which was officially announced in State gazette, issue 58 from 23.07.2019 and on the website of TU-Gabrovo, to meet the needs of department “Communication Technologies and Equipment” which is a constituent unit of the Faculty of Electrical Engineering and Electronics; with applicant: Chief Assistant Professor Ivelina Stefanova Balabanova, Ph.D. Member of the scientific jury: Prof. D.Sc. Mihail Petkov Iliev

1. Brief biography details

There is one applicant participating in the competition: chief assistant Ivelina Stefanova Balabanova, Ph.D. The candidate graduated TU-Gabrovo in 2001 with a degree in electronics. She has worked as assistant professor in the department of ‘Communications technology and equipment’ since 2005 and defended a Ph.D degree in 2007.

2. General description of submitted materials

The applicant participates in the competition with 43 papers and works which include 1 monograph, 37 publications in journals and proceedings of scientific conferences plus 5 teaching materials and methodology guides. I have accepted for review 41 of them excluding №36 and №37 of which I am a co-author. Submitted works with regard to their number, authors and place of publication are distributed as follows:

- 5 of sole authorship (№ 1, 2, 3, 10, 12);
- 30 with co-authors;
- 19 were published in English including 9 publications in foreign editions(№ 4, 6 ,7, 8, 26, 29, 32, 33, 35);
- 16 in Bulgarian;
- 6 in editions with ISSN abroad (№ 6, 26, 29, 32, 33, 35);
- 13 in editions with ISSN in Bulgaria(№ 9,10,11,12,13,14,15, 16, 17, 18,19, 22,23);
- 13 in international scientific conferences held in Bulgaria (№ 1, 3, 4, 5, 20, 21, 24, 25, 27, 28, 30, 31, 34);
- 3 in international conferences held abroad (№ 2,7,8)

3. Citations of candidate’s publications as reflected by the scientific community

It is evident from the publications, which were submitted for review, that the candidate has the following 27 citations in publications issued in Bulgaria and abroad:

- 17 citations in Bulgaria (1 in a monograph, 1 in a publication indexed in Scopus and 7 in the international portal ROAD);
- 10 citations in foreign editions including 8 indexed in Scopus database. It will be correct to maintain that the scientific production of Ms. Iva Balabanova is known to the research and science community concerning the subject matter of this competition.

4. Overview of content and results in the submitted works

Said scientific works can be categorized in two major fields:

- **Research, modeling of processes, creation of tools and devising methods in telecommunications transfer lines and optical communications**—publications [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 32, 33] and study guide [4].

These publications contain measurements and investigations in pulse transfer, included attenuations, dispersion, strength and reliability; impact upon transfer channels; signal-to-noise ratio in high speed optical fiber systems; optical components and coaxial cable lines [1-4]. Also derived in there are criteria of technology selection, configuration in development and set up of networks [5]. Further, there have been developed methods for calculation of parameters in various types of optoelectronic circuits [6]. Designed circuits for generating dephased pulses; transformation of luminance and the ratio between two types of luminance into frequency; multichannel measuring of temperature [7, 8, 11]. A model for determining failure probability has been defined based on already modeled variants for routing of WDM networks, plus methods for control of laser diodes emitting in the infrared sector of the spectrum [9, 10]. Models of tele-traffic processes have been created based on various topologies (star, ring and others.) and MPEG-encoded video signals [12, 14]. A set of problems related to asymmetry of channels in CATV networks has been analyzed and there have been proposed a strategy for solution by employing DOCSIS protocol [13]. Also carefully investigated are architectures of artificial neural and tree type structures for identification of tele-traffic systems with evident losses [15, 16]. Innovations in the area of electronics and photonics such as single-electronics and single-photonics have been investigated [17]. Qualifiers have been created and there has been investigated the impact of various parameters of tele-traffic models of voice services [18, 20, 21, 22, 26]. Some models of multiple choice selection of solution of neuro-fuzzy systems with different input variables for quantitative analysis of service units in tele-traffic systems $D+M+H_2+E_3/D/n/k$ have been created plus virtual tools for testing the efficiency of qualifiers [19, 23, 24, 25]. Also derived are regression models on the basis of artificial intelligence and “decision tree” statistical method for the purpose of identifying the type and forecasting of traffic parameters in Markov chains [32, 33].

A set of exercises has been developed and a study guide in “Communications and multiplex equipment” has been published“ [4].

- **Development of applications and synthesis of models for identification in communication circuits and filtering of signals with available noises -**

publications [27, 28, 29, 30, 31, 34, 35], study guides [1, 2, 3, 5] and monograph written [6].

There have been developed software tools based on LabVIEW for designing digital recursive and non-recursive filters, for filtering of signals with added noise influence and statistical evaluation of applied types of filtering. A set of methods have been proposed for designing of filters and digital processing of signals implemented with MATLAB graphic user interfaces [27, 28]. Artificial intelligence capacities have been investigated In MATLAB medium along with adaptive neuro-fuzzy interface systems during computer modeling of IIR and FIR filters plus identification of electric signals with overlaid noises [27, 29, 35]. Based on discriminant analysis there have been synthesized linear type of qualifiers concerning analogue and digital signals with additional noises [30]. Internet based LabVIEW virtual systems have been developed for designing and investigation of digital filters' characteristics using various algorithms. Also included in user relational data bases Microsoft SQL and MySQL are modules for storing data arrays related with filters' parameters and coefficients during calculations of the transfer function of said filters [27, 31, 34].

Lab exercises have been developed and study guides prepared in the subjects of "Communications circuits"; "Digital processing of signals" and "Signals and systems" [1, 2, 3, 5].

The candidate's monograph implements the equipment of artificial neural networks, adaptive neuro-fuzzy systems, discriminant analysis (DA), the algorithm of Base (B's A), methods of k-nearest neighbors (k-NN) and decision tree (DS) in the development, analysis and selection of models in the communications field of identification of electric signals with available noises.

5. General description of candidate's activity

5.1. Teaching and pedagogical activity (work with students and postgraduate students)

Dr. Balabanova reads lectures in TU-Gabrovo in the subjects: "Communications circuits", "Communications and multiplex equipment", "Telecommunications transfer lines", "Theory of tele-traffic" and "Electromagnetic compatibility". These are taught to third and fourth year fulltime and part-time students enrolled in the bachelor degree courses of "Mobile and satellite communications" (MSC) and "Communications technologies and equipment" (CTE) as well as to students in the third semester of their studies in master degree courses in the above majors. She has also conducted seminar and lab exercise classes in the subjects: "Training practice", "Signals and systems", "Communications circuits" and "Communications and multiplex equipment" with 1st, 2nd, 3rd and 4th year students from above bachelor degree courses. Ms. Balabanova has read lectures in "Communications circuits" and "Optical communications" to master degree students in their initial/ preparatory stage of studies at Technical College - Lovech.

The candidate has advised 56 graduates of which 38 for bachelor degree and 18 in the master degree. She has reviewed 37 bachelor and master degree theses and participated in State examination juries for awarding bachelor and master degrees to students majoring in MSC and CTE. Dr. Balabanova has provided academic advice and

support to students who worked on their papers for participation in student scientific sessions held at TU-Gabrovo.

As university teacher and academic advisor Dr. Balabanova makes use of various software products such as MATLAB, LabVIEW, STATISTICA, Visual basic, Altium Designer, Multisim, Microsoft SQL, MySQL, Cisco tracer and others.

5.2. Scientific and applied research activity

Ms. Balabanova has been a major team player in 7 successfully completed projects, 6 of which have been on university level, related mainly with quality improvement in network services plus 1 joint project with partners TUG and the Ministry of Economy, Energy Supply and Tourism.

The scope of scientific interest of the candidate comprises several fields such as optical communications, tele-traffic design, digital processing of signals, artificial intelligence and neuro-fuzzy systems, clusterization of data, methods of statistical processing and derivation of knowledge from data during information diagnostic and others.

Publications authored by Dr. Balabanova have been awarded with “THE BEST PAPER and Crystal Prize” award at an international scientific conference held in the University of Russe. A large part of her research work is reflected in her scientific publications which were issued both in Bulgaria and abroad. In them Dr. Balabanova has employed advanced methods and resources and proposed new methodologies of research in the area of telecommunications.

5.3. Implementation activity

The candidate was the manager of a project requested by the company “VIDEOSAT KTC” Ltd. with a seat in the town of Veliko Tarnovo. In her capacity of project manager she has carried out research and implementation related to analysis and improvement of service quality in TV signals transfer.

Dr. Balabanova has developed and implemented in the process of teaching and instructing some lab set-ups and software applications in optical communications, in investigation and analysis of electronic devices, computer networks and others.

6. Contributions (scientific and applied research).

In analyzing the submitted materials I classify the candidate’s contributions in applied research and applications as follows:

In the field of research, modeling of processes, development of tools and methods in telecommunications transfer lines and optical communications.

Applied research contributions:

- Processes of pulse transfer in high speed fiber optic systems have been investigated;
- A review has been made of the methods for measuring of attenuation, dispersion, strength, reliability and other parameters of optic fibers plus criteria for selection of technology and optimum configuration of nodes during setup of optical nets;
- Evaluation has been made of CSO, CTB and CNR impacts in coaxial and fiber optic transfer media. As a result there were proposed arrangements and modes of tuning of system elements that effectively bring about to higher quality of service;

- Some methods for calculation of parameters of various types of optoelectronic analogue circuits have also been developed;
- There has been defined a model for determining failure probability by means of Deixtra algorithm in networks of spectral multiplexing. Also proposed are methods and solutions for calculation of drivers for control of laser diodes based on DOCSIS protocol for channels in cable TV networks;
- Using artificial intelligence there are synthesized qualifiers for identification of tele-traffic system with evident losses, average timeout in the system with a model of voice service and system $D+M+H_2+E_3/D/n/k$ and Markov chains $M/M/c$ and $M/M/c/k$;
- Also investigated are some neuro-fuzzy architectures with variation in the input variables for recognition and classification of parameters in teletraffic model of voice service;
- Graphic models have been developed for multiple choice solution at different levels of branching truncation and metric units for distances according to DP and k-NN methods for identification of systems with evident losses, models of voice sources and $D+M+H_2+E_3/D/n/k$ systems, and Markov chains $M/M/c$ and $M/M/c/k$;
- There are derived regression models for defining average timeout factors in the systems and probability of losses with tele-traffic model of voice sources through experimentation planning and evaluation of plans by regression analysis;
- Here is analyzed the influence of incoming calls intensity upon the average timeout in the system and probability of losses for certain model of voice service;
- Based on the selection of experimentation plan, there have been obtained regression models for forecasting parameters of certain type tele-traffic systems;
- A study guide in the subject "Commutation and multiplex equipment" has been developed for experimental research in lab settings.

Contributions in terms of application

- Circuits have been designed for generating phase shifted pulses, transformation of illuminance into frequency and four-channel device for temperature measurement;
- There have been developed LabVIEW virtual tools which integrate neural and neuro-fuzzy qualifiers for identification of tele-traffic service units, presentation and analysis of input traffic.

In the field of development of applications and synthesizing identification models in communications circuits and filtering of signals with available noise.

Applied research contributions:

- Application of mathematical tools in telecommunications systems during identification of analogue and digital signals with reflected availability of noises has also been analyzed;
- Similarly, linear discriminant qualifiers for identification of sinusoidal and rectangular signals with available periodic noise and "pink" noise have been synthesized;
- WEB-based information systems have been designed for experimental computer aided modeling and analysis of the characteristics of IIR and FIR filters, MSSQL

and MySQL configuring of user access and data storage for the purpose of research and instruction;

- There have been investigated structures of adaptive neuro-fuzzy interface systems for recognition and classification of signals with sinusoidal, rectangular, triangular and saw-like shape with added constant “white” noise and “pink noise“;
- Also selected are multilayer neural architectures with various types of neural activation for identification of signals with and without six highly efficient types of noise.

Contributions in terms of application:

- A set of virtual applications has been developed for simulation design of digital recursive and non-recursive filters based on various types of approximations and algorithms, filtering of signals and statistical analysis of signals prior to and after applied filtration;
- Data bases of server-based systems Microsoft SQL and MySQL have been created for the purpose of file organization and data storage during functionality check-up of LabVIEW applications.

My assessment of the candidate’s contributions is as follows:

- These have largely contributed to the enrichment of both knowledge and systems through formulation of innovative approaches in the respective scientific areas.
- Creation of modified algorithms and methods for obtaining assertive outcomes.

7. Evaluation of candidate’s personal contribution.

From the total of 41 scientific works 5 publications and the monograph are authored entirely by Dr. Balabanova whereas in 14 of the publications she is the first author. Concerning the rest of publications I have not been given a discriminative record about the percentage share of co-authorships, therefore, I accept their contribution as being of equivalent share. This assumption, plus the analysis of all scientific works submitted for review, make me feel confident to feel sure that contributions from item 6 of this evaluation report are the product solely of Dr. Balabanova.

8. Critical remarks and recommendations

On the grounds of the overall analysis of reviewed works I, hereby, state my remarks and recommendations concerning the prospective work of Dr. Balabanova:

- A large number of said works were published mainly in national editions and events which is why I would recommend that Ms. Balabanova find out opportunities for publishing the outcomes of her scientific work in editions and conferences that are referred by leading scientific data bases with good renown among scientific communities;
- The focus of her research and scientific work should be focused on a concretely specified scientific area;
- The candidate will do well if she becomes more active in her professional interaction with doctoral students and young scientists that, eventually, could lead to selection of a team whose capacity may warrant the achievement of more

substantial outcomes and participation in national and international research projects and programs.

9. Personal impressions

I have known Dr. Balabanova for more than ten years. We have worked together in joint projects and I am also well familiar with her scientific products. Her colleagues, with whom I have worked on a number of occasions, also make positive references about her academic and research practice. All these give ample ground for my conviction that my opinion of the candidate's whole work has been adequately and objectively shaped.

In my opinion the amount and quality of scientific products and the professional realization of Dr. Ivelina Balabanova, do meet the requirements of the Academic Staff Development in Republic of Bulgaria Act as well as the corresponding Rule for Implementation of that Act, and the requirements of Technical University –Gabrovo for occupying the academic position of “Associate Professor”.

10. Conclusion:

All the materials submitted for reviewing and participation in the competition are sufficient in terms of amount and content. The quantity of submitted papers and works considerably exceeds the minimum required limit for awarding the academic position of Associate Professor. Drawing upon the analysis of the scientific product submitted for participation in the announced competition, it is evident that Dr. Ivelina Balabanova has done an adequate amount of significant educational and research work and has published articles, papers and teaching materials. The scientific product of her work features the demanded applied research and application contributions. By making a comprehensive evaluation of the outcomes of the candidate's activity I am confident that they meet the requirements for awarding the academic position of “Associate Professor”.

Taking into account what has been stated above I propose that Chief Assistant Professor Dr. Ivelina Balabanova be awarded the academic position of “Associate Professor” at TU-Gabrovo in higher education area 5. “Technical Sciences” and professional field 5.3 “Communication and Computer Engineering”; scientific specialty “Communication Networks and Systems”.

20.10. 2019 y.

Reviewer: /signature/
/ Prof. D.Sc. Mihail Iliev /