

# REVIEW

**authored by Prof. Seferin Todorov Mirtchev, D.Sc.  
to the academic position of “Professor”, in a professional field  
5.3. Communication and Computer Engineering  
at the Technical University - Sofia**

**concerning scientific papers and works submitted for participation  
in competition for the academic position of “Associate Professor”  
in the field of higher education – 5. Technical Sciences,  
professional field – 5.3. Communication and Computer Engineering,  
scientific specialty – “Communication Networks and Systems”  
(Wireless Communications and Broadcasting, Security Equipment)**

In the competition for „Associate professor“, announced in the State Gazette, issue 68/31.07.2020 and on the website of TU-Gabrovo for the needs of the Department of Communication Equipment and Technologies at the Faculty of Electrical Engineering and Electronics, as a candidate participates Ch. Assist. Prof. Krasen Kirov Angelov, PhD – Technical University – Gabrovo.

## **1. Brief biographical data**

Krasen Angelov, PhD was born in 1980 in the town of Gabrovo. He graduated from the Technical School of Mechanical and Electrical Engineering “Dr. Nikola Vasiliadi” – Gabrovo in 1999. He graduated with a bachelor's and master's degree from the Technical University – Gabrovo, specialty “Communication Equipment and Technology” respectively in 2003 and 2005 with a professional qualification “Communication Engineer”. He defended his doctoral thesis on “Research about Opportunities for Two-Way Transmission of Digital Information over the Upstream Channel of Cable Television Networks” on the doctoral program “Communication Networks and Systems” in 2016.

Since 2005 he has been a full-time PhD student at the Department of Communication Equipment and Technology at the Technical University – Gabrovo, in 2008 he was appointed a full-time assistant in the same department after a competition on scientific specialty “Communication Networks and Systems” (Signals and systems). In 2016, he was appointed Chief Assistant after winning a competition in PF 5.3. Communication and Computer Engineering, specialty “Communication Networks and Systems” (Analog circuitry).

As areas of professional interest, the candidate has indicated: wireless communication systems for the Internet of Things and industrial Internet of Things, broadband wireless communications; security and fire-alarm systems, access control and video surveillance; optical communication networks and systems; big data processing technologies.

He is an author of 15 scientific publications for the last 5 years and a co-author of 1 textbook. He holds certificates for graduating Cisco Academy.

## **2. General description of the submitted materials**

A total of 45 scientific works were submitted for reviewing:

- 10 scientific publications (habilitation work) indexed in Scopus, two of them are with SJR, and one of them is indexed in WoS and has IF;
- 3 scientific publications indexed in Scopus, one of them with SJR;
- 29 scientific publications in journals and conferences with scientific review;
- 2 handbooks and 1 textbook.

The candidate's publications are distributed as follows: 4 articles in international journals and 9 conference papers, which are indexed in Scopus and WoS, 2 of which are single-authored; 5 articles in journals and 24 papers at conferences with scientific review, 2 of which are single-authored. From the 42 presented publications, 25 were published in English and 17 in Bulgarian. The candidate is a co-author of 3 published textbooks.

All presented scientific papers are in the scientific field of Communication Networks and Systems.

The candidate's scientometric data exceed the minimum national requirements, as can be seen from the table.

Group of indicators	Minimum national requirements – “Associate Professor”	Ch. Assist. Prof. Krasen Angelov, PhD
<b>A</b>	<b>50 pt.</b>	<b>50 pt.</b>
<b>Б</b>	-	-
<b>B</b>	<b>100 pt.</b>	<b>180 pt.</b>
<b>Г</b>	<b>200 pt.</b>	<b>303.39 pt.</b>
<b>Д</b>	<b>50 pt.</b>	<b>70 pt.</b>
<b>E</b>	-	<b>23.33 pt.</b>

The candidate meets the minimum requirements of TU – Gabrovo to the scientific and teaching activities of candidates for academic positions “Associate Professor”, in particular – there are 42 scientific publications for the competition, 4 of them single-authored and 1 with IF, 10 citations and 3 textbooks.

The above shows that with the presented scientific publications, citations, published textbooks and participation in research projects, the candidate Krasen Angelov, PhD fully covers the minimum national requirements for holding the academic position of „Associate Professor“ for the field of “Technical Sciences”.

### **3. Reflection of candidate’s scientific publications among the scientific community (known citations)**

A total of 10 citations are presented, 6 of which are in Scopus indexed publications, 1 in a publication abroad and 3 in publications in Bulgaria.

The citations of the publications of Krasen Angelov, PhD show that he is known to the scientific community in the country and abroad with the results of his research work.

### **4. Overview of the content and results of the submitted scientific work**

Submitted by Ch. Assist. Prof. Krasen Angelov, PhD, scientific work for review are summarized in 6 areas:

1. Wireless communications and broadcasting;
2. Optical communication networks;
3. Systems and services in the satellite and cable television networks;
4. Reliability and fault tolerance of communication networks;
5. LED lighting;
6. Digitization of church art works.

The first area includes 7 publications (B.4.1, B.4.4, B.4.5, Г.7.1, Г.8.3, Г.8.14, Г.8.29). There are proposed approaches for optimal planning of radio coverage in wireless communication networks for various communication technologies: narrowband energy efficient communications, broadband cellular communications and computer networks. Solutions based on LoRaWAN technology are presented – a platform for providing experimental access and

testing of applications, evaluation of the efficiency of the technology and the quality of provided radio coverage in urban environments is developed; Demonstration models for educational and research purposes, using systems with software-defined radio, are developed.

The second area includes 11 publications (B.4.2, B.4.7, B.4.8, B.4.9, Г.8.1, Г.8.2, Г.8.4, Г.8.6, Г.8.7, Г.8.13, Г.8.15). In them are developed computer models of single-channel and multi-channel optical communication lines for high-speed signal transmission. The modulation processes of the optical signals and the methods for dispersion compensation are considered. Solutions for optimal construction of networks with optical amplifiers and regeneration sections are proposed. Computer models for planning, research and analysis of the behavior and efficiency of passive optical networks are developed and a model of PON network with capabilities for transmission of TV and IP signals and network monitoring is practically realized.

The third area includes 20 publications (B.4.3, B.4.10, Г.7.3, Г.8.8, Г.8.9, Г.8.10, Г.8.12, Г.8.16, Г.8.17, Г.8.18, Г.8.19, Г.8.20, Г.8.21, Г.8.22, Г.8.23, Г.8.24, Г.8.25, Г.8.26, Г.8.27, Г.8.28). Experimental studies of the parameters and characteristics of the satellite channel for transmission of digital television programs according to the DVB-S/S2 standard are performed. Simulation and experimental laboratory models with the necessary measuring instruments and software are synthesized. The parameters of the received signal from different transponders of the Hot Bird 13 satellite are measured. Experimental laboratory stands for research and analysis of systems for terrestrial, cable and satellite digital television with capabilities for streaming, real-time monitoring and research of coding and modulation processes of digital signals are developed. The influence of the nonlinear distortions from the second and third order on the channel spectra is considered and studied. Various approaches are proposed and analyzed for the upgrade to a fully optical transmission medium, as well as for the introduction of modern interactive IP-based services and broadband high-speed access in cable television systems.

The fourth area includes 2 publications (B.4.6, Г.8.11). In them the reliability of the equipment in providing communication services is modelled and the probability of failure in a multi-channel optical network is assessed.

The fifth area include 1 publication (Г.7.2). It is developed, implemented and studied an interactive LED system for ambient lighting effects in multimedia systems.

The sixth area include 1 publication (D.8.5). The challenges and approaches to the digitalization of works of art in the Bulgarian Orthodox churches during the Renaissance are examined. The digitalization includes: use of a wide range of specialized filters and lenses; use of variable spectrum light sources – infrared and ultraviolet light; creating digital copies of single objects, which are then combined using sophisticated software to obtain complete three-dimensional models.

## **5. General description of the candidate's activity**

### **5.1. Educational and pedagogical activity (work with students and postgraduate students)**

Krasen Angelov, PhD has a long teaching career in the Department of Communication Engineering and Technology at TU-Gabrovo (12 years).

During his teaching as an assistant, Krasen Angelov led laboratory exercises in the disciplines “Analog Circuitry”, “Signals and Systems”, “Digital Signal Processing” and “Design Automation” in the bachelor's degree from the curricula of specialties “Communication Equipment and Technology”, “Electronics” and “Automation, Information and Control Systems”.

After his appointment as chief assistant, the classroom employment of the candidate is: 2019/2020 - 873 hours; 2018/2019 - 617 hours; 2017/2018 - 618 hours; 2016/2017 - 587 hours.

In the last 5 years he has been teaching a full course of study (lectures and laboratory exercises) on 4 disciplines in the bachelor's degree on “Communication Equipment and Technology” and “Mobile and Satellite Communications”: “Wireless Communications and Broadcasting”, “Security Equipment”, “Audio and video equipment” and “Cellular Communications”, as well as 1 discipline in the master's degree on “Communication Equipment

and Technology”: “Information Technology in Communications”. On the disciplines “Cable Television Networks” and “Broadband Mobile Networks” in the master's degree, as well as on the “Television Equipment” in the bachelor's degree, he has been teaching laboratory exercises.

Krasen Angelov, PhD is a co-author of 3 textbooks on 2 subjects and has developed methodological materials for e-learning in 4 subjects. He is the compiler of curricula in 5 disciplines: “Wireless Communications and Broadcasting”, “Security Equipment”, “Access Control Systems”, “Audio and Video Equipment” and “Information Technology in Communications”. Now he actively participates in the development of curricula in 4 disciplines for the newly created in TU - Gabrovo specialties “Communication Technologies and Cybersecurity” and “Digital Administration” in the bachelor's degree.

From 2016 until now Krasen Angelov was the supervisor of a total of 50 graduates (34 in the Bachelor's degree and 16 in the Master's degree).

In his extracurricular work with students, Krasen Angelov, PhD was their research supervisor in participation with 8 papers at the Student scientific session of TU - Gabrovo and 1 paper at the international scientific conference UNITECH. He is participated in the supervision and preparation of student teams with works presented at: national competition and exhibition “Youth Technical Creativity” – Gorna Oryahovitsa (2017 - 2019), national hackathon “Academy of Innovation: IDEAS 2018” – Sofia and in the “Gabrovo Innovation Camp 2018”.

The candidate is actively participated in the development of the material and technical base in the laboratories at the Department of Communication Equipment and Technology at the Technical University – Gabrovo. Since 2016, the candidate is developed over 20 laboratory models and exercises in various disciplines of the curriculum of the specialty “Communication Equipment and Technology”: models for monitoring and research of wireless communication channels for communication and quality of radio coverage in narrowband and broadband communication networks; demonstration modules of access control systems, security and fire-systems; models of systems for audio signal processing and optical effects in multimedia systems; simulation models and practical model of passive optical network, etc.

## **5.2. Scientific and scientific-applied activity**

Krasen Angelov, PhD is participated in 4 national projects under the Operational Program “Science and Education for Smart Growth” and 2 national projects at the Research Fund of the Ministry of Education and Science, as well as in 4 university research projects (in one of which he is a head of).

Under the supervision of the candidate is in the period of development and implementation university project 1910E, “Development and research of innovative information-based modules and systems for communication in the Internet of Things (IoT)” at the University Centre for Research and Technology (UCRT) of TU - Gabrovo (2019 - 2021). The results of this project are published in 6 publications focused on scientific and applied developments in the field of the wireless communication networks, 4 publications focused on modelling and optimization of optical communication lines and 1 publication related to predictive analysis of the reliability of the communication systems.

Krasen Angelov, PhD has 8 verified reviews for the period 2017 - 2018 in the international scientific journal IET Electronics Letters (with IF 1.231); he was a reviewer of scientific papers at the international scientific conferences ELECTRONICS - ET and UNITECH.

To the scientific and applied activity of the candidate can be added his participation in the organizing committee, as well as his participation as a lecturer in the international scientific forum “Models for implementation of innovative technologies in the context of Industry 4.0” - Gabrovo, held in 2018.

The candidate is a member of the Union of Scientists in Bulgaria.

### 5.3. Implementation activity

As a result of the participation in the implementation of 10 research projects and the presented publishing activity, it is evident that in the last 5 years the candidate has participated in the design of 3 applied developments with potential for implementation.

A demonstration model of a platform for providing experimental access for developing and testing applications for intelligent communication in IoT based on LoRa communication technology is developed. The platform is implemented for teaching and research purposes in Gabrovo and in particular at the Technical University – Gabrovo. Based on the platform, a demonstration service for intelligent parking management is developed.

The development of a practical model of passive optical network (PON) for delivery of interactive services is implemented on the territory of TU - Gabrovo. The model is capable to provide training, research and testing of new services.

A prototype system with interactive ambient LED lighting for installation to flat panel displays and solid-state multimedia presentation screens is created at the Department of Communication Equipment and Technology.

### 6. Contributions (scientific, scientific-applied, applied).

I have accepted the 11 contributions to the scientific papers presented by the candidate in the author's reference. I have categorized the contributions of the materials submitted for review for participation in the competition as “scientific-applied” and “applied” as follows:

- *Scientific-applied contributions in the 10 scientific publications (habilitation thesis) in publications that are indexed in international databases with scientific information Scopus and WoS.*

1. A LoRaWAN platform for providing experimental access for creating and testing applications for intelligent communication in IoT, evaluation of the efficiency of the technology and the quality of the provided radio coverage in urban environments is developed;

2. Models for research, analysis and evaluation of the performance of high-speed (from 10 to 40 Gbps) single-channel optical networks using different formats for optical signal modulation (NRZ, RZ, CSRZ, DM, and MDRZ), different schemes for dispersion compensation (symmetric compensation, pre- and post-compensation) and solving optimization problems are created;

3. A module for receiving and retransmitting digital satellite (DVB-S/S2) signals over an IP network and for real-time monitoring of the parameters of the broadcast satellite signals is developed;

4. Demonstration models of communication multi-channel LoRaWAN gateway and LoRa-based communication platform for application in intelligent systems, as well as for educational and research purposes are developed, using software-defined radio systems;

5. Models of a wireless MIMO channel for indoor communication is synthesized and studied, taking into account the characteristics and spatial-temporal properties of the channel, the electromagnetic propagation of the signals and the parameters of the used antennas;

6. Models for modelling, research and implementation of prediction analysis of the reliability and fault tolerance of communication networks, systems and service devices by applying Markov chains are synthesized;

7. Simulation models of multi-channel (4 and 8) high-speed (10 to 40 Gbps) optical communication networks for solving optimization problems according to the criteria of achieving a minimum value of BER or maximum Q-factor and providing maximum performance and efficiency of the network at different input parameters of the signals are developed;

8. A simulation and experimental model (platform) of a passive optical network (PON) for delivery of interactive services, which provides convenient and easy staff training and the provision of a wide variety of practical research, are developed;

9. A simulation model for optimal planning and dimensioning of the length and number of amplifying sections in optical transmission networks with wavelength multiplexing is developed;

10. A simulation and analytical model for estimating the probability of error in the different types of quadrature modulations used in the transmission of digital signals in the reverse channel of cable television networks (CATV) are developed.

- *Scientific-applied contributions in the 35 publications submitted for the competition in the various scientific fields outside the 10, which substitute the habilitation thesis. These contributions coincide with and supplement the above:*

1. Radio coverage of the LoRa/LoRaWAN network on the territory of the town of Gabrovo as a part of a platform for communication and testing of applications based on the developed overall LoRaWAN architecture is studied;

2. A demonstration model of an intelligent parking system is developed and implemented, which uses an energy-efficient LoRa-based transmission module, autonomous power supply and possibility of integration into a scalable intelligent platform;

3. The parameters and characteristics of a satellite channel for transmission of digital television programs in standard DVB-S/S2 are experimentally studied. An experimental laboratory model with the necessary measuring instruments and software is synthesized;

4. Methodologies based on the iterative approach for optimal planning and sizing of the length and number of amplifying sections in coaxial and optical transmission networks are developed.

The formulated scientific-applied contributions show that the work done by the candidate as a lecturer and researcher is highly innovative and fully complies with the requirements for the competition for the academic position of “Associate Professor”.

The obtained results have a completeness and are suitable for application both in scientific and applied work and in the educational process. The candidate's research can be assessed as enrichment of existing knowledge

## **7. Assessment of candidate’s personal contribution**

The researches, conclusions and contributions from the scientific production of the candidate are assessed in the scope of the national and international scientific journals and forums, indexed in Scopus or in Web of Science, which is a guarantee for the significance of the achieved results and contributions.

The publication activity of the candidate shows his in-depth knowledge in the various subfields of telecommunications, his ability to bring research to implementations, his active participation in teamwork and undoubtedly his merits for the results and contributions. The candidate is a promising young specialist and teacher.

## **8. Critical remarks and recommendations**

I have no significant critical remarks to the materials of the competition and in particular to the scientific works of Dr. Krasen Angelov.

I recommend the candidate to continue his research activity by selecting a specific subfield of telecommunications from the wide thematic area so far, in which to conduct in-depth scientific research and to have a leading role.

## **9. Personal impressions**

I know the candidate from our joint work on a research project, since he was a full-time PhD student in the Department of Communication Engineering and Technology at TU - Gabrovo. We have also met at scientific conferences.

My impressions are that the candidate is responsible, competent in his field, conscientiously performing his duties, knows the scientific sources, professional and technical literature and the current state in the field of competition.

The candidate has very good computer skills and speaks English at a good level, which helps him in his research and teaching activities.

## **10. Conclusion:**

**In view of the above, I propose Ch. Assist. Prof. Krasen Angelov PhD to be awarded the academic position of “Associate Professor” in the field of higher education 5. Technical Sciences, professional field 5.3. Communication and Computer Engineering, scientific specialty “Communication Networks and Systems” (“Wireless Communications and Broadcasting”, “Security equipment”).**

October 26, 2020

Reviewer: /signature/

/Prof. Seferin Mirtchev, DSc /