

REVIEW

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concerning materials submitted for participation in a competition for awarding the academic position of “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 Cybersecurity in WiFi Networks, Internet of Things (IoT) and Cybersecurity Systems)

In the competition for the academic position of “professor”, announced in the State Gazette, issue 48/13.06.2025 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”, Assoc. Prof. Krasen Kirov Angelov, PhD – TU-Gabrovo participated as a candidate.

1. Brief biographical data

Assoc. Prof. Krasen Angelov, PhD, was born in 1980 in Gabrovo. He graduated from secondary education at the Technical School of Mechanics and Electrical Engineering “Dr. Nikola Vasiliadi” – Gabrovo in 1999. Consecutively in 2003 and 2005 he graduated with a bachelor’s and master’s degree in “Communications Engineering and Technologies” at the Technical University – Gabrovo. In 2016 he defended his educational and scientific degree “doctor” in the doctoral program “Communication Networks and Systems” at the Technical University – Gabrovo with the topic of his dissertation “Research on the possibilities for two-way digital information transmission in the upstream channel of cable television networks”.

After winning a competition in the scientific specialty “Communication Networks and Systems” (Signals and Systems) in 2008, he was appointed to the position of “assistant” at the Department of “Communication Equipment and Technologies” at the Technical University of Gabrovo. Since 2016, he has held the position of „chief assistant“ (PF 5.3. Communication and Computer Engineering, specialty “Communication Networks and Systems” (Analog Circuit Engineering)). In 2020, he was elected to 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). From 2023 to the present, Assoc. Prof. Angelov also holds the administrative position of Head of the Department of “Communication Equipment and Technologies” at the Faculty of Electrical Engineering and Electronics at the Technical University of Gabrovo.

The main areas of professional interest and scientific activity declared by the candidate are: systems and technologies for wireless communications in the Internet of Things, broadband wireless communications; security, access control and video surveillance systems; optical communication networks and systems; cybersecurity.

2. General description of the submitted materials

For participation in the competition, a total of 43 scientific papers were submitted:

- 26 scientific publications in journals that are referenced and indexed in world-renowned scientific information databases (indicators B.4 and Γ.7);
- 15 scientific publications in non-refereed peer-reviewed journals or in edited collective volumes (indicator Γ.8);
- two textbooks (indicator E.23).

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

3. Reflection of candidate's scientific publications among the scientific community (known citations)

The list of citations for participation in the competition includes 26 publications in scientific journals, referenced and indexed in world-renowned databases (Д.12).

The citations of the publications of Assoc. Prof. 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 in the presented works

The publications submitted by the candidate in the competition for the academic position of "professor" are divided into three thematic areas of communication networks and systems, directly related to the competition.

In the first thematic area: "Cybersecurity in wireless communication networks", scientific results related to: the development, research and analysis of encryption, authentication and access control mechanisms to protect data and ensure the integrity and confidentiality of communication; the security and management of the large amount of data generated by IoT devices; the application of artificial intelligence (AI), including machine and deep learning, in intrusion prevention systems (IPS), are presented.

In [Г.7.1, Г.8.3], models for integrating AI into image encryption systems and intrusion prevention and identification (IPS) systems are developed.

In [Г.7.5], a custom encryption algorithm with implementation of AES-128 encryption in Cipher Block Chaining (CBC) mode and key expansion for application in encryption, authentication and access control systems for data protection and ensuring the integrity and confidentiality of communication in 5G mobile cellular networks is presented and investigated.

In [Г.8.5, Г.8.6], a methodology is developed to analyze the challenges associated with managing the vast amount of data generated by Internet of Things (IoT) devices, assess the risk, and categorize security threats in IoT networks in order to select and implement appropriate countermeasures to enhance security. In [Г.8.6], a categorization of the diverse roles and responsibilities of stakeholders in IoT ecosystems is proposed, allowing for a better understanding of their interrelationships. This categorization facilitates more effective decision-making by taking into account the specific context and responsibilities of each stakeholder group. This approach improves the decision-making process in the field of IoT security management and the prioritization and allocation of resources to address the most critical security risks in building a secure and reliable IoT platform.

In [B.4.8], the synthesis and application of a hyperchaotic synchronization system for secure communication using chaotic masking is presented. A chaotic synchronization scheme between two identical new mathematical models of fourth-order hyperchaotic systems is designed to serve as the basis for secure data transmission using chaotic masking over unprotected communication channels.

The publications in *the second thematic area "Communication Technologies and Applications in the Internet of Things"* are related to: synthesis of methodologies for optimal prediction and analysis of radio coverage of wireless communication networks; modeling, research and analysis of the performance of communication networks and protocols for IoT; the development and research of experimental setups and practical experimental demonstration models and prototypes of systems related to the implementation and application of communication technologies in IoT.

In [B.4.6, Г.7.4, Г.8.7], a methodology for predicting and analyzing the radio coverage of IoT networks (5G, WLAN (IEEE 802.11ax) and LoRaWAN) is proposed to determine their maximum range for wireless data transmission in industrial networks of the Internet of Things. An experimental setup has been developed to assess the quality of radio coverage, the capabilities and applicability of LoRaWAN technology in the relevant scenarios and conditions of long distances, large coverage areas and complex terrain.

In [Г.8.12, Г.8.14, Г.8.15], models have been developed for research and analysis of LoRaWAN performance, focusing on assessing reliability in terms of channel access in the physical layer of the network, the performance of IoT communication protocols for the application layer, the performance of LoRa modulation at different values of the spread factor and comparison with conventional modulation formats.

Experimental setups and practical experimental demonstration models and prototypes of systems related to the implementation and application of an energy-efficient narrowband long-range communication network (LoRa) in the IoT concept have been developed: management and monitoring of indoor lighting systems [Г.7.3]; control and monitoring of indoor lighting systems [Г.7.3]; system for measuring, visualizing and controlling electrical and non-electrical parameters of low-voltage power supply networks [Г.7.7]; autonomous power supply optimizing the energy consumption of IoT end devices in different operating modes [Г.7.10]; a smart home electrical control and power panel has been developed that supports functionality for IoT control and management in real time [Г.7.12]; an exemplary architecture for remote intelligent management and control of household appliances in a home automation system has been developed [Г.8.13]; a project has been developed for the implementation of an intelligent system for tracking and monitoring vehicles in real time, based on the application of LoRa technology as a wireless communication infrastructure in the IoT and smart cities concept [B.4.5].

In [Г.8.1], a visible light communication (V2X) system using wavelength division multiplexing (WDM) is proposed for simultaneous transmission of data streams from different sources over a free space optical (FSO) channel with applications in traffic management and road safety in urban and non-urban environments.

The third thematic area “Monitoring, control, management and optimization of resources in communication networks” considers models and solutions oriented towards ensuring the quality of services, operability and reliability and effective management of communication networks. The following have been developed: computer models for experimental study of factors affecting the quality of radio coverage in wireless communication networks [B.4.1, Г.7.2]; models with advanced methods for channel coding, power control and signal amplification intended for new generation mobile cellular networks [B.4.2, B.4.3, B.4.7, B.4.9]; models for assessing and optimizing the performance of 5G NR mobile cellular networks through the analysis of spatial data obtained using convolutional neural networks (CNN) and sequential data analyzed using long short-term memory networks (LSTM) [Г.7.6, Г.7.9]; models for performance analysis and solving optimization problems for high-speed multi-channel active and passive optical communication networks [Г.7.8, Г.7.14, Г.7.15, Г.8.4].

In [Г.7.11] the implementation, analysis and evaluation of a transmission channel under different conditions of communication with artificial pico- and nanosatellites is presented. Various solutions for SDR-based systems for monitoring radio frequency signals have been developed and studied: in the VHF and UHF radio frequency range [Г.7.16]; a radio frequency platform for studying and analyzing the spectral characteristics and parameters of radio communication signals [Г.8.2]; an SDR-based frequency downconverter for a satellite receiver according to the DVB-S2 standard [Г.8.11]; a platform for monitoring IP video streaming [Г.8.9]. In [Г.8.8] a solution has been developed and the performance of an artificial intelligence system for image and object recognition has been studied.

In [B.4.4], a prototype of a universal integrated system for monitoring communication networks and devices, mounted in a chassis for installation in a 19" communication cabinet, was developed. The applicability, functionality and advantages of the developed system are demonstrated through several examples of use.

5. General description of candidate's activity

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

Assoc. Prof. Krasen Angelov has participated in the development of the curricula and lectures on the disciplines “Wireless Communications and Cybersecurity in WiFi Networks”,

“Broadband Mobile Networks”, “Electromagnetic Compatibility”, “Access Control Systems”, “Security and Monitoring Systems”, “Internet of Things (IoT) and Cybersecurity Systems”, “Information Cybersecurity Management Systems”, “Identification and Countermeasures of Cyberattacks”, included in the curricula of specialties at the Faculty of Electrical Engineering – full-time and part-time study for the educational qualification degree “bachelor” and “master”.

To ensure the educational process with the participation of the candidate, textbooks on “Digital Television Technologies” and “Wireless Communications” have been published.

He is the scientific supervisor of over 110 graduates in the Bachelor's and Master's degree programs. Currently, he is the scientific supervisor of 3 doctoral students and one doctoral student who has defended his educational and scientific degree of “doctor” in the doctoral program “Communication Networks and Systems”.

5.2. Scientific and scientific-applied activity

To participate in the competition, the candidate has submitted 41 scientific publications (articles in journals and reports at conferences), of which 26 are in editions, referenced and indexed in world-renowned databases of scientific information (Scopus/Web of Science), 3 of which have an “Impact factor” and 8 have an SJR rank. Of the total number of 41 publications, 6 are self-authored and 35 are co-authored (4 with two authors, 14 with three authors and 17 with more than three authors, in 10 of which he is the first author). There are 15 articles and papers at scientific conferences in Bulgarian, and 26 in English. A total of 2 textbooks have been published, one of which he is the self-authored and the other – co-author. The publications do not repeat the articles, papers, textbooks and teaching aids for the educational and scientific degree “doctor” and the academic position “associate professor” attached to the competition documentation. The candidate has participated in a large number of national and international scientific and educational projects. In the competition materials, he listed 11 national projects (indicators E.18 and E.20), of which he is the project leader in 4 and a participant in 7, and he is a participant in 1 international project (indicator E.19).

The documentation for the competition presents evidence of fulfillment of the minimum national requirements and the requirements of TU-Gabrovo for holding the academic position of “professor”:

Group of indicators	Content	Minimum required points by groups of indicators for holding the academic position of “Professor”	Declared points by groups of indicators for holding the academic position of “Professor”
A	Indicator 1	50	50
B	Indicator 2	-	0
B	Indicator 3 or 4	100	138
Г	Sum of indicators 5 to 11	200	394,03
Д	Sum of indicators 12 to 15	100	260
E	Sum of indicators 16 to 28	150	261,92

Content	Minimum requirements of TU - Gabrovo for holding the academic position of “Professor”	Declared indicators by the candidate for the academic position of “Professor”
Total number of publications (articles and papers)	30, of which at least 5 self-authored and 3 with IF (WoS)	41, of which 6 self-authored, 3 with IF (WoS), 8 with SJR (Scopus)

Number of known citations by other authors	20	26
Published textbooks/books	2	2
Published teaching aids	-	-
Number of successfully defended doctoral students	1	1
Project and contract management	3	4

5.3. Implementation activity

No officially submitted company documents for implementation have been attached to the competition materials. Nevertheless, the candidate participates as an expert in various projects with the business and the Municipality of Gabrovo, related to the implementation of wireless communication technologies for various applications in the field of the Internet of Things and Smart City.

The candidate has also participated in the creation of laboratory practicums and laboratory setups for laboratory and practical training of students in the disciplines “Access Control Systems”, “Broadband Mobile Networks”, “Wireless Communications and Cybersecurity in WiFi Networks” and “Internet of Things (IoT) and Cybersecurity Systems”.

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

The main part of the candidate's scientific, scientific-applied and applied contributions are within the topic of the announced competition and confirm his qualities as a teacher and scientist.

Scientific contributions:

1. A modified image encryption scheme based on the OTP (One-Time Pad) algorithm is developed, consisting of chaotic synchronization with feedback control to create complex and unique encryption keys and artificial neural networks (ANN) for improved security, efficiency, and resilience to various cryptographic attacks.

2. A hyperchaotic synchronization system based on a scheme with two identical new mathematical models of fourth-order hyperchaotic systems is developed and researched. The synchronization combines projective, marginal and hybrid chaotic synchronization. An active control based on the second Lyapunov stability law has been synthesized. Stable chaotic synchronization between two nonlinear systems has been achieved, which serves as the basis for secure data transmission via chaotic masking over unprotected communication channels.

3. An improved neural network model is created and studied, combining spatial data (obtained using convolutional neural networks – CNN) with sequential data, which is analyzed using long short-term memory (LSTM) networks for the purpose of predicting radio wave attenuation in a 5G network.

4. A robust control is synthesized for a class of nonlinear systems with parametric uncertainties through modified input-output linearization via feedback with linear-nonlinear decomposition.

Scientific-applied contributions:

5. An innovative approach to categorization through clustering and cross-validation using different algorithms of the key roles and responsibilities of stakeholders and their influence on ensuring cybersecurity in IoT ecosystems is proposed and investigated. The approach aims to effectively prioritize and allocate resources to address the most critical security risks in building a secure and reliable IoT platform.

6. Simulation models are developed for predicting and analyzing the quality of radio coverage of a LoRaWAN network to determine its maximum range, parameters, quality of service (QoS), and performance under complex changes in configuration parameters.

7. An improved approach for designing, building and deploying low-power mesh networks in an indoor scenario based on IQRF technology is proposed and investigated.

8. Advanced methods for power and signal level control in next-generation mobile cellular networks, based on centralized, distributed, and machine learning approaches, are researched and analyzed.

Applied contributions:

9. A prototype of a universal integrated system for monitoring wired and wireless communication networks and communication nodes is developed and validated.

10. Demonstration models are developed for the implementation of an energy-efficient narrowband long-range communication network (LoRa) in the Internet of Things (IoT) concept for various application scenarios: control and monitoring of indoor lighting systems; measurement, visualization and control of electrical and non-electrical parameters of low-voltage power supply networks in real time; remote intelligent management and control of household appliances in a home automation system; vehicle tracking in an urban environment.

11. A practically oriented approach is developed to optimize the energy consumption of LoRaWAN end devices with autonomous power supply in different modes of their operation.

12. A MATLAB-based 5G NR downlink physical layer simulation model is developed and investigated for the purpose of realistic 5G NR performance evaluation.

13. Approaches and simulation models are developed and investigated for research, analysis and evaluation of performance and solving optimization problems in high-speed multi-channel passive and active optical networks using different optical signal modulation formats (NRZ, RZ, CSRZ, DM, MDRZ), and different dispersion compensation schemes (symmetric compensation, pre- and post-compensation).

7. Assessment of the candidate's personal contribution

The research, conclusions and contributions of the candidate's scientific output have been approved within national and international scientific journals and forums, indexed in Scopus or in Web of Science, which is a guarantee of the significance of the achieved results and contributions.

The candidate's publications demonstrate his in-depth knowledge in various subfields of telecommunications, his ability to translate scientific research into practical applications, his active participation in teamwork, and undoubtedly his contributions to the results and achievements.

8. Critical remarks and recommendations

I have no significant comments to dispute the main scientific and applied scientific contributions in the works presented by Assoc. Prof. Angelov. The works submitted for participation in the competition give me reason to recommend the publication of materials for the needs of the educational process in the field of the announced competition – textbooks, teaching aids, courses, etc. It would be good for the candidate to focus his research activities on creating a team involving colleagues, doctoral students, and students, and to develop and implement scientific research projects at the national and international level in order to develop his expertise and implementation activities in the registration of utility models and patents.

9. Personal impressions

I have known Assoc. Prof. Krasen Angelov for several years and consider him to be a worthy and fair colleague who conscientiously fulfills his duties as a university lecturer and researcher and demonstrates the necessary academic ethics towards his colleagues and students.

10. Conclusion:

In view of the above, I propose that Assoc. Prof. Krasen Kirov Angelov, PhD be elected to the academic position of “professor” in the field of higher education – 5.

Technical sciences, professional direction – 5.3. Communication and Computer Engineering, specialty – “Communication Networks and Systems” (Wireless Communications and Cybersecurity in WiFi Networks, Internet of Things (IoT) and Cybersecurity Systems).

29.10.2025

Reviewer:

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