

REVIEW

about the PhD thesis for acquisition of the scientific degree "doctor"

in the professional field **5.3. „Communication and computer technics“**

Ph.D. program „**Communication networks and systems** “

Author of the PhD thesis: **Krasimir Jivkov Terziev**

Title of the PhD thesis: **MODERN SATELLITE COMMUNICATION SYSTEMS AND INNOVATIVE METHODS FOR INCREASE THEIR EFFICIENCY**

Ph.D. supervisor: Professor Dimitar Karastoyanov, PhD

Reviewer: Prof. D.Sc. Ph.D. Eng. Todor Atanasov Stoilov, Institute of information and communication technologies – Bulgarian Academy of Sciences (IICT-BAS), Sofia, Acad.G.Bontchev str., BL.2

1. General notes

The Ph.D. thesis contains 171 pages. It is structured in 4 chapters, contributions, a list of published publications, list of references. The list of references contains about 100 positions with publications and virtual available documents.

2. Actuality of the problems in the PhD thesis

The own contribution of the dissertation concerns the design of the antenna part of a satellite communication system. The antenna part is implemented as an engineering facility and the Ph.D. thesis contains data about measurements of the parameters of the designed antenna system. This thematic focus of the dissertation work is relevant for the implementation of specialized communication elements of a satellite communications system using low-orbit satellites.

The scientific and applied result of the dissertation work is expressed in the design of an engineering facility, its construction, and the evaluation of the parameters of the antenna system. As can be seen from the presented analyses and comparisons of the designed and developed system, it has better technological parameters than the currently implemented systems. This is a prerequisite for higher quality implementation of communication links and increasing the reliability of their operation and exploitation.

The Ph.D. study and its contents have the character of designing a real technical system and evaluating its functional qualities.

I positively assess the thematic orientation of the dissertation work. I believe that the researches described in the dissertation work have a scientific-applied, pragmatic, and useful value, as it addresses necessary and important elements of problems of effective management of communications implemented through satellite systems. I believe that the topicality and importance of the developed topic are easily understandable.

The reviewer evaluates the research in the dissertation positively. The scientific and applied part of the dissertation research is easy to understand. I believe that the importance of dissertation research is evident, the results obtained are useful and give a positive certificate for the qualification of the candidate.

3. Degree of knowledge of the state of the problem and academic interpretation of the literary material

The dissertation work makes a meaningful presentation of possible technical solutions and the problems that have a place in the transmission of data through satellite communications. Technological achievements, solutions, and features of a class of low-orbital communication satellites are reported. A set of necessary parameters that must be implemented in this class of telecommunication systems are considered.

Chapter 1 provides an analysis and overview of the development of the technology of satellite communications, their technological properties, and the potential for use and operation. The development of satellite technologies is presented and the need to transition communication systems to low earth orbit is justified. Potential benefits for this class of satellite communications have been evaluated.

The inevitability of developing new technological solutions that adapt to the features of low-orbital communication systems is noted as the intention of the research.

4. Correspondence of the chosen research methodology and the set goal and tasks of the dissertation with the contributions achieved

The Dissertation aimed to design and develop an essential part of a satellite communication system for low-orbital solutions. This subsystem was chosen to be the antenna ground part of the satellite telecommunications system. Chapter 2 analyzes the structure and technical issues to be addressed in low-orbit satellite communications systems. Functional block solutions are presented, where the blocks can be technically realized with different technological means. The use of such a satellite system is motivated to perform additional services besides data transmission, such as video monitoring of various phenomena: disasters, fires, and agro-technological features.

The third chapter is the content part of the design of the antenna system for satellite communication. Technological parameters that the design must achieve are defined. A minimal set of technical elements was chosen together with the antenna

subsystem for the complete construction of the ground technology platform for satellite and communications.

In chapter four, the data on achieved technological parameters of the antenna part of the telecommunications system are presented. The data is obtained as a result of measurements. It is essential that the obtained results are compared with available antenna systems, which proves that good technological properties and characteristics of the designed and developed antenna system have been achieved.

The PhD student demonstrates a good knowledge of the operational processes of satellite communications systems in the case of low-orbital satellites. This is a consequence of the implementation of a comprehensive design and development process of the technological antenna subsystem.

The reviewer positively assesses the candidate's qualifications for the design, development, testing, and experimentation of technical characteristics of an essential technical subsystem of low-orbital satellite communication systems. The results of Chapter 4 demonstrate the achieved high professional training of the doctoral student in the field of designing communication systems.

5. Scientific and practical achievements in the PhD thesis

The thesis develops and evaluates technological solutions for creating the ground part of a communication system that can use data and operating modes of low-orbit satellites. A feature of the dissertation work is that the research is not limited to design but also to the technological construction of an essential part of such a system, in this case, it is the antenna subsystem. Accordingly, the research has logically continued to the measurement, analysis, and comparison of the technological parameters of the development and assessment of its potential performance by comparison with existing solutions.

I believe that the developed topic has a scientific-applied nature in the part of design, development, and analysis of achieved technological characteristics of a technical communication subsystem. I positively assess the results of the doctoral student's research. They have a useful practical character and potential for practical application by proving the usefulness and pragmatics of research in the dissertation work.

I consider these contributions to be sufficient for this dissertation work. They prove that the doctoral student can independently carry out research activities, and develop problems that have a complex and difficult character due to the complex and implicit nature of processes in communication environments. These studies have an important place and a positive potential for the current management and operation of technical communication systems.

When reading the dissertation work, one must be convinced that the achieved results are mainly the personal work of the candidate.

6. Correspondence with the minimal national legislative requirements

The reviewer assesses that the submitted publications correspond to the topic and content of the dissertation work. There are 7 publications, which are presented.

One of the publications was presented as a conference report abroad and indexed in SCOPUS. One publication was made in a journal in our country (Problems of Engineering Cybernetics and robotics). The remaining 5 publications were presented at scientific conferences in our country (International Scientific and Technical Conference Automation of Discrete Production ADP, ROBOTICS, AUTOMATION AND MECHATRONICS-RAM).

I find that the presented publications fulfill the requirements for the defense of the educational and scientific degree "doctor". The PhD student does not submit a citation list of his publications. I appreciate that the presented publications give a positive certificate for the PhD student for his obtained results.

According to the PPZRASRB for the fulfillment of the minimum national requirements for receiving the ONS "Doctor" in professional direction 5.3. "Communication networks and systems" requires the presence of at least 30 points under Indicator Group G. My verification of the submitted publications satisfies this requirement through criteria G7 and G8: scientific publications in peer-reviewed peer-reviewed journals or edited collective volumes.

7. Significance of the research and application achievements in the PhD thesis

Doctoral student Krasimir Terziev demonstrated skills for analysis and assessment of technical parameters of subsystems that have a place in the composition of ground stations for satellite communication. These skills and knowledge are aimed at finding solutions to increase the technological parameters of an antenna subsystem. The practical usefulness of the research consists in the construction of an antenna subsystem whose technical characteristics have been studied and measured. The PhD student demonstrates skills and qualifications to design and create good solutions for technical elements of a ground satellite communication station. Practical use of the developed antenna subsystem is declared.

The doctoral student demonstrates skills in the analysis of technical parameters that have a place in the antenna part of the communication system.

The reviewer considers that the dissertation research is useful and has led to potentially pragmatic results such as finding solutions to increase technical parameters of the ground communication part of a satellite communication system.

In the presented documents, there is no data on the distribution of author contributions in the presented publications.

8. Few assessments, recommendations, and remarks

I positively evaluate my presented dissertation work. It is evident from its content that the doctoral student has conducted independent research work.

The reviewer has no comments regarding the content of the dissertation.

As a form of recommendation, I consider that the doctoral student should appear among an international academic audience and present his results at international conferences and scientific journals.

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The reviewer finds the doctoral student Krasimir Zhivkov Terziev shows experience and qualifications for conducting independent research in the field of designing and developing elements of a satellite communication system.

Conclusion

I give a positive assessment of the scientific-applied and applied results in the PhD thesis of Krasimir Zhivkov Terziev. I found that the legislative requirements of the Law for academic growth in Bulgaria, and the Regulations for its application are satisfied. This gives me the reason to recommend to the honorable Scientific Jury to award **Krasimir Jivkov Terziev** the educational and scientific degree "Doctor" in professional field 5.3 " **Communication and computer technics** ", scientific specialty " **Communication networks and systems** "

12.02.2023

Review

Prof. D.S.

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