

REVIEW
by Prof. Dr. Eng. Rosen Ivanov Pasarelski,
New Bulgarian University

of the dissertation
for the acquisition of the educational and scientific degree "Doctor" in
the field of higher education 5. Technical Sciences,
professional field 5.3 "Communication and Computer Engineering",
doctoral program "Communication Networks and Systems"

Topic: "Methods and Tools for Intelligent Monitoring and Control of Radio Channels in Wireless Communication Networks"

Author: Eng. Mihail Georgios Angelakis

1. Topic and relevance of the dissertation

The modern development of telecommunication applications, the increasing mobility of end users and the constantly increasing volume of transmitted data place high demands on the reliability, security and efficiency of wireless communication links. Intelligent management and control of radio channels create the possibility of dynamic optimization of network parameters and adaptation to changing conditions of the radio environment. This determines the need to develop and implement effective methods for monitoring, analysis and management of the state of radio channels, which take into account the influence of interference, user mobility and traffic dynamics. The main directions include dynamic management of the radio frequency spectrum, assessment of the quality of the communication channel, adaptive control of the transmission power and optimized allocation of available radio resources.

The dissertation develops those related to the development of a system model with signal recognition, interference and channel state change in order to adapt transmission parameters without human intervention. This aims to reduce data loss and improve network resilience.

The concept considered in the dissertation includes the integration of smart mechanisms for controlling the radio channel with the radio access infrastructure, which is key to achieving high throughput and low latency.

Technologies around the application of modern methods for channel estimation, loss prediction and adaptive spectrum and power allocation lead to higher capacity and better network efficiency.

The topic of the dissertation is relevant, scientifically significant and corresponds to modern trends in the development of wireless communication systems aimed at intelligent management of radio frequency resources and increasing the efficiency of radio access networks. The developed issues are in line with the priority research directions in the field of

5G/6G communications, therefore I assume that the choice of the topic is fully justified and the relevance of the dissertation is undeniable.

2. Review of the cited literature

The bibliography of the used literature includes a total of 95 literary sources, of which 3 are in Bulgarian, 82 - in English, and 10 Internet sources.

It is noticeable that the majority of the cited publications were published in the last seven years, which indicates a desire to use current scientific developments and modern research results.

The analyzed literature sufficiently and completely reflects the current state and scientific and applied achievements achieved at the global level in the field of wireless communications, and in particular in the field of radio frequency channel management. Based on the literature analysis, the goal and objectives of the dissertation work are formulated clearly, reasoned and consistently.

I believe that the doctoral student has demonstrated in-depth knowledge of the researched scientific problem, a high level of analytical thinking and the ability to formulate theoretical conclusions and practical recommendations. The analyses and conclusions made have scientific and applied value regarding wireless communication network technologies and the challenges associated with their planning, design, construction, monitoring, management and optimization.

3. Research Methodology

The dissertation is prepared in a total volume of 126 pages and includes 64 figures, 21 tables and 14 formulas. A substantiated formulation of the subject area, the object of research, the goal and tasks of the dissertation is made. The structure of the dissertation includes a sequence of four chapters with formulated conclusions for each of them. General conclusions are made on the dissertation and summarized scientific and applied contributions are made.

The dissertation uses the methods of analysis of the literature and theoretical sources related to the issues of monitoring and control of radio frequency channels in modern wireless networks: comparative analysis, induction and deduction, software modeling, experiment in a real environment.

For the purposes of the study, in Chapter 2, imitation modeling of a wireless communication channel with an integrated intelligent algorithm for suppressing interference is applied. In Chapter 3 – software planning, practical implementation, experimental research, monitoring and control of wireless radio coverage in a wireless P2MP communication network for a real object. And in Chapter 4 – experimental research through a developed experimental model of a universal system for intelligent monitoring and control of a wireless communication network in a real environment.

The methodology used is adequately selected and fully corresponds to the set goal, tasks and subject of the study. The combination of theoretical analysis, simulation modeling, software implementation and experimental verification in a real environment provides a

reliable basis for validating the results obtained and confirms the scientific validity of the conclusions made.

4. Contributions of the Dissertation

The dissertation of Eng. Mihail Angelakis is a complete, logically consistent and well-structured scientific research, in which solutions aimed at the intelligent monitoring and control of radio frequency channels in modern wireless communication networks have been developed and experimentally validated. The author demonstrates in-depth knowledge of the researched issues through the development, analysis and evaluation of models, algorithms and practical approaches that contribute to increasing the efficiency, reliability and adaptability of wireless communication systems. Based on the assessment, I assume that the contributions formulated by the doctoral student are correctly justified, reflect the achieved results and can be classified as applied and applied, as follows:

Applied scientific contributions:

- 1) A complex methodology for multi-criteria analysis and assessment of the state of wireless radio channels and an architectural model for proactive monitoring of wireless networks have been developed, based on the effective combination of standard telemetry protocols with algorithms for dynamic monitoring of parameters in a heterogeneous hardware infrastructure.
- 2) Criteria and algorithmic rules for automatic identification of anomalies and pre-emergency states have been formulated, which allow mathematically justified prediction of connection degradation before the occurrence of a real communication failure.
- 3) An innovative model of a wireless connection channel with an integrated intelligent algorithm for noise and interference suppression has been proposed and studied. The model successfully solves the critical problem of the lack of correct information about the channel state (CSI) by applying a specialized training module for filtration. This allows for more accurate reconstruction of CSI and achieving a significantly lower mean square error (NMSE) in prediction compared to the application of traditional algorithms.

Applied contributions:

- 1) A specialized platform for intelligent monitoring has been designed, software implemented and researched, which provides reliable collection and processing of data in real time about the state of the wireless infrastructure.
- 2) Software solutions for graphical interfaces have been developed to increase situational awareness, including interactive logical maps on a real geographical background and optimized visualizations for video walls in dispatching and network operations centers (NOC).
- 3) An automated signaling and event management module has been developed, which automates the process of detecting and localizing problems in the radio

channel of wireless communication networks. By conducting a series of tests in real conditions and simulated critical scenarios, the high accuracy, speed, and fault tolerance of the developed solution has been experimentally verified.

5. Publications and citations of publications on the dissertation work

The public presentation and approbation of the results of the dissertation work are ensured through 8 scientific publications, representing reports from scientific conferences, included in the National Reference List of NACID. The presented publication results form a total scientific asset of 76.64 points, which significantly exceeds the minimum required 30 points according to the minimum national scientometric requirements and the internal regulatory requirements of the Technical University - Gabrovo for acquiring the educational and scientific degree "doctor".

Of the presented publications, two are independent, and the remaining six are realized in co-authorship with the scientific supervisor and other researchers. All publications are in Bulgarian and present main results related to the scientific and applied scientific research developed in the dissertation work.

When analyzing the presented materials, no evidence of citations of the publications related to the dissertation work was found.

6. Authorship of the obtained results

A significant volume and depth of scientific research work has been carried out on the topic of the dissertation work, aimed at solving current scientific and applied scientific tasks in the field of intelligent monitoring and management of radio channels in wireless communication networks. The researched issue is a dynamically developing area, which is also confirmed by the wide scope and relevance of the literary sources used.

The analysis of the presented dissertation work, the developed models, algorithms, experimental studies and publication materials on the topic give reason to assume that the main part of the obtained scientific and applied results are the personal merit and significant contribution of the doctoral student Eng. Mihail Angelakis. The contribution of the doctoral student to the conducted research is expressed in the development, implementation and experimental verification of the proposed solutions, as well as in the analysis of the obtained results.

7. Abstract and author's reference

The presented abstract to the dissertation work of Eng. Mihail Angelakis is 40 pages long and fully reflects the main statements, methods, obtained results and contributions of the conducted scientific research. It is structured logically and consistently, following the structure of the dissertation work and correctly presents the essential elements of the development. The content of the abstract complies with the requirements of the Law of the Development of Academic Staff in the Republic of Bulgaria and the Regulations for its implementation, therefore its quality assessment is positive.

The attached author's reference adequately presents the main stages of the scientific research work carried out, the methods used, the achieved results and the scientific and applied contributions made within the framework of the dissertation work.

The practical applicability of the results of the dissertation research is expressed in the development of methodological approaches, models and procedures for the design, implementation and optimization of systems for intelligent monitoring and control of wireless communication networks. The proposed solutions related to the choice of architecture, the configuration of technical means and the evaluation of radio channel parameters create prerequisites for increasing the reliability, efficiency and quality of the provided communication services.

The research conducted contributes to enriching the existing knowledge in the field of intelligent management of wireless communication systems, as the obtained results have practical applicability and capacity for implementation in real communication environments with a pronounced technical and economic effect.

8. Opinions, recommendations and remarks on the dissertation

I believe that the presented dissertation has been developed in the required volume and has the required scientific depth, as it contains justified scientific and applied contributions. The doctoral student's scientific research activity has been carried out at a high level, and the results obtained have the necessary significance for acquiring the educational and scientific degree "doctor". The publicity of the results is ensured by presenting them in scientific publications at refereed and indexed scientific conferences.

I do not identify any significant critical remarks on the scientific production and development submitted for review. The recommendations made are mainly aimed at the future development of the research work and include: improving the scientific style when formulating the main theses, analyses and conclusions; expanding and systematizing the terminology used by supplementing the list of abbreviations; optimizing the presentation of the software implementation by limiting the description of standard technical operations and emphasizing the scientifically significant aspects of the developed solutions.

In view of the significance and relevance of the research topic, I recommend that the doctoral student in his future professional and research activities:

- expand his participation in international research and development projects related to the development of wireless communication systems, intelligent networks and next-generation technologies;
- direct his efforts to publishing the results of his research in international scientific journals with high scientific prestige, indexed in the global databases Scopus and Web of Science;
- develop his competencies in the field of applying artificial intelligence, machine learning and automated optimization methods in the design, management and analysis of modern communication networks.

It should be emphasized that the notes and recommendations made do not reduce the significance of the research work performed and the results obtained in the dissertation. They

are intended to support the future professional development of the doctoral student and to outline possible directions for upgrading his scientific and applied activities.

9. Conclusion

I believe that the presented dissertation meets the requirements of the Law of the Development of Academic Staff in the Republic of Bulgaria, as well as the regulatory requirements for acquiring the educational and scientific degree "doctor".

The scientific and applied results obtained and presented in the dissertation, the formulated contributions and the scientific research work performed give me reason to propose to the esteemed scientific jury to award eng. Mihail Georgios Angelakis the educational and scientific degree "doctor" in the field of higher education 5. Technical Sciences, professional field 5.3 "Communication and Computer Engineering", doctoral program "Communication networks and systems".

01.08.2026

Reviewer:

/Prof. Dr. Eng. Rosen Pasarelski/