

OPINION

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dissertation for the award of the educational and scientific degree "**PhD**"

by: field of higher education **5 Technical sciences**

Professional field 5.3. **Communication and computer engineering**

Doctoral programme "**Automation of areas of the intangible sphere (medicine, education, science, administration, etc.)**"

Author: mag. eng. Sezgin Fakhri Ismail

Topic: "**Parametric and structural optimization of telecommunication models**".

Scientific supervisor: Prof. Dr. Slavi Yassenov Lyubomirov - Paisii Hilendarski University.

1. General presentation of the procedure and the PhD student

By Order No. RD-21-668/24.03.2023 of the Rector of Paisii Hilendarski University of Plovdiv I have been appointed as a member of the scientific jury in the procedure for the defense of a dissertation on "**Parametric and Structural Optimization of Telecommunication Models**" 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 technology, doctoral programme "Automation of areas of the intangible sphere (medicine, education, science, administration, etc.)" with author **mag. eng. Sezgin Fakhri Ismail**. The set of paper materials submitted by the PhD student is in accordance with Article 36 (1) of the Regulations for the Development of the Academic Staff of PU and PP of ZPAS in the Republic of Bulgaria. The doctoral candidate has attached 5 publications on the topic of the dissertation.

Mag. eng. Sezgin Ismail graduated in 1992 at the secondary school "Dr. Petar Beron" – town Momchilgrad, with a degree in the field of Mathematics.

In the period 1992-1997 he studied at the Paisii Hilendarski University of Plovdiv, completing in 1997 a five-year course with the specialty "Mathematics and Informatics Teacher".

Mag eng. Sezgin Ismail has additional specialization at Sofia University "Kliment Ohridski" from 2018 to 2019, acquiring "Second professional qualification degree".

Since 1999 eng. Ismail is a lecturer in the field of "Informatics and information technology" at the "Nikola Yonkov Vaptsarov" Secondary School - town Momchilgrad.

I don't know Mag. Eng. Sezgin Fakhri Ismail personally, but I believe he is an experienced IT educator who is constantly improving his knowledge and skills.

2. Topical relevance

In recent years there has been active work in the development of new telecommunication systems and networks and models for them. The presented dissertation is focused on parametric and structural optimization of telecommunication models and search

for new methods and approaches addressing the causes affecting the quality performance of telecommunication networks and systems. Methods for ensuring reliable transmission, processing and protection of information in telecommunication networks are developed and presented. Evolutionary and genetic algorithms are applied. Emphasis has been put on the use of artificial intelligence methods and techniques in assessing the state of components in telecommunications systems. I believe that the considered problem is topical.

3. Knowledge of the problem

PhD student Eng. Sezgin Fakhri Ismail has cited 132 literary and informational sources, of which 7 are in Cyrillic and the rest in Latin (95%). Most of the cited papers were published in the last 10 years.

From the list of cited literary sources, it can be concluded that the PhD student has thoroughly insight into the contemporary global situation and developing trends of the problems addressed in the dissertation.

4. Research methodology

The dissertation is 161 pages, with two appendices - 22 pages. It is organized in four chapters, an introduction, a conclusion (general conclusions), a description of contributions, a list of the doctoral student's publications and a bibliography (literature used).

Chapter I of the thesis discusses the factors determining the reliability of telecommunication networks. The applied optimization methods are discussed, focusing on evolutionary algorithms for optimization of telecommunication models as one of the directions of artificial intelligence. An analysis is made of the possibilities of applying genetic algorithms and the particle swarm optimization (PSO) method to models of telecommunication systems.

An analysis of the state of the problem has been carried out and the aim and objectives of the thesis have been defined.

Chapter II presents the methods used for modelling, simulation and optimization of telecommunication systems. Artificial intelligence methods (genetic algorithms, PSO) in system identification and optimization are presented in detail.

Chapter III, Ph.D. student Ismail, has devoted to test models of telecommunication devices to which the identification methods based on artificial intelligence techniques will be applied (of a linear system with and without noise, of a third-order analog bandpass filter with Chebyshev characteristic, of a PLL loop with 3rd- and 4th-order low-pass filters, and a nonlinear model of a cooling system of communication equipment). The developed models are used to: evaluate the performance of the code implementing the genetic algorithm and the particle swarm optimization, to conduct Monte Carlo simulations to estimate the parameters of linear and nonlinear communication systems, and to estimate the structure of a linear communication system.

Chapter IV, Experimental Studies, presents experimental results testing the models developed in Chapter III using genetic algorithms and the particle swarm optimization (PSO) method. A comparison and analysis of the results obtained is made. Conclusions are formulated.

5. Characteristics and evaluation of the thesis and contributions

After thorough acquaintance with the dissertation and the publications of Eng. Sezgin Ismail, I am convinced that the results obtained from the research and development are attained entirely with his participation. With the presented work, the PhD student has demonstrated his knowledge and skills for in-depth research and solving scientific problems of scientific and applied nature.

After reading the attached scientific works of Eng. Ismail, I believe that the ideas developed and the results obtained have become available to the scientific community in our country through publications and conference presentations.

In the self-assessment of the contributions presented by the PhD student, a total of 8 contributions are formulated, which are classified as scientifically applied (3 pcs.) and applied (5 pcs.). I believe that the presented contributions faithfully reflect the results obtained by Eng. Sezgin Fakhri Ismail.

Scientific and applied contributions are in the field of computer communications and networks, software and computer modelling.

In my opinion, the contributions concern the adaptation of known methods and algorithms and the creation of new models, technologies and software using artificial intelligence in a dynamically developing field such as telecommunications.

6. Assessment of publications and personal contribution of the PhD student

The results obtained during the development of the thesis are presented in five publications. One of the publications is independent, and in another PhD student Eng. Sezgin Ismail is the first author. The other three publications are refereed and indexed in Web of Science. I believe that the PhD student's publications on the dissertation reflect the main contributions claimed.

7. Abstract

The submitted abstract meets the requirements for its preparation. It correctly reflects the main results and contributions of the thesis.

8. Recommendations for future use of the dissertation contributions and results

Mainly my recommendations are in the direction of taking into account the specificity of real telecommunication systems in the proposed models and comparing the proposed with classical methods of research and analysis.

These recommendations do not go to the substance of the contributions, and therefore do not affect my personal positive impression of the scientific production and other merits of the PhD student.

CONCLUSION

After thorough acquaintance with the dissertation and the publications of Eng. Sezgin Ismail, I am convinced that the results obtained from the research done were attained entirely with his participation. With the presented thesis, the PhD student has demonstrated his capabilities for research activity and solving scientific problems of scientific and applied nature.

The dissertation **contains scientific-applied and applied results that represent an original contribution to science** and **meet all the** requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria (LADAPB), the Regulations for the Implementation of the LADAPB and the relevant Regulations of Paisii Hilendarski University.

On the basis of the analysis, I give a **positive** evaluation of the developed dissertation and I think it is justified to propose **Mag. Eng. Sezgin Fakhri Ismail** to acquire the degree of Doctor of Education and Science in the scientific field 5. Technical sciences, professional field 5.3. Communication and computer engineering doctoral program "Automation of areas of the intangible sphere (medicine, education, science, administrative activities, etc.)"

15.05.2023 г.

Prepared by:
Assoc. Prof. Dr. Eng. Nikolay Shopov