OPINION

by Dr. Rumen Kostadinov Popov - Professor at University of Plovdiv "Paisii Hilendarski"
on a dissertation for the award of the educational and scientific degree **"Doctor"**

By: field of higher education *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.).*

Author: *Sezgin Fakhri Ismail*

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

Scientific supervisor: *Assoc. Prof. Dr. Slavi Yasenov Lyubomirov - Plovdiv University "Paisii Hilendarski"*

1. General presentation of the procedure and the PhD student

By Order No. RD-21-668 of 24.03.2023 of the Rector of Plovdiv University "Paisii Hilendarski" (PU) I have been appointed as a member of the scientific jury for providing a procedure for the defense of a dissertation on "Parametric and structural optimization of telecommunication models" for the acquisition of the educational and scientific degree **PhD** in the field of higher education 5 Technical sciences, professional field, 5.3. Communication and Computer Engineering, doctoral program "Automation of areas of the intangible sphere (medicine, education, science, administrative activity, etc.)". The author of the dissertation work is Sezgin Fakhri Ismail - PhD student in full-time study at the Department of ECIT with scientific supervisor Assoc. Prof. Dr. Slavi Yasenov Lyubomirov from Plovdiv University "Paisii Hilendarski"

The set of paper materials submitted by Sezgin Fakhri Ismail is in compliance with Article 36 (1) of the Regulations for the Development of the Academic Staff of PU and includes the following documents: application to the Rector of PU for the opening of the dissertation defense procedure; CV in European format; minutes of the departmental council related to the reporting of the readiness for the opening of the procedure and to the preliminary discussion of the dissertation; dissertation; abstract; list of scientific publications on the topic of the dissertation; copies of scientific publications; declaration of originality and authenticity of the attached documents; certificate of compliance with the minimum national requirements. The doctoral candidate has attached 5 copies of his publications on the subject of the dissertation.

All necessary and required documents and materials have been submitted in accordance with Art. 36 (1) of the Regulations for the Development of the Academic Staff of Paisii Hilendarski University of Plovdiv and the Law on Academic Staff Development. All of them have been prepared diligently and correctly.

Mag. Sezgin Ismail has completed his secondary education at the secondary school "Dr. Petar Beron" - town of. He graduated with a degree in Mathematics in 1992. He completed his higher education in 1997 at Paisii Hilendarski University - Plovdiv, with the specialty "Teacher of Mathematics and Informatics".

From 2018 to 2019, Mag. Sezgin Ismail is conducting additional specialization at the University of Sofia "Kliment Ohridski", acquiring "Second Professional Qualification Degree".

Since 1999, he has been a teacher at "Nikola Yonkov Vaptsarov" Secondary School in the town of Sofia. He is a professor of "Informatics and Information Technologies" in Momchilgrad.

I know Mag. Sezgin Fakhri Ismail personally, and my good impressions of his qualifications in the field of information technology were acquired during his training as a PhD student in the ECIT Department. He performed very well in the examination on "Automated Information Processing Systems in Research" that I conducted.

2. Relevance of the topic

Based on the literature review and the analysis performed, it is evident that the development of new versions of stochastic evolutionary algorithms is a current and active direction in modern scientific research worldwide.

The tasks set in the dissertation are currently very relevant: to carry out a study and analysis of the existing methods, techniques and tools of artificial intelligence for the estimation of the structure and parameters of the basic components of communication systems; to create test simulation models of specific classes of modules and devices for communication systems; to create and test specific procedures implementing the genetic algorithm (GA) and particle swarm optimization (PSO); to apply the methods of numerical experiment and Monte-Carlo simulations to to investigate the possibilities of GA and PSO algorithms for automated determination of the parameters and structure of classes of modules and devices specific to telecommunication systems; to investigate the significance of the factors affecting the convergence, error and speed of individual algorithms and to perform a comparative analysis of the qualities of the proposed algorithms; to derive approaches for the application of the researched methods of artificial intelligence in practice.

3. Knowledge of the problem

The reference list contains 132 publications, of which only 7 are Internet sites. Most of the cited sources are articles in journals indexed in Scopus. 125 of the publications are in English. Most of the cited sources were published after 2005, which indicates the existence of a thorough analysis of the current state of the art.

In the process of working on the dissertation, the doctoral student evaluated and creatively interpreted the literature using his own ideas in developing the evaluation algorithms tested.

4. Research methodology

As a baseline, the dissertation chooses the Monte Carlo simulation method to test stochastic models whose parameters and structure are estimated using artificial intelligence methods - genetic algorithm (GA) and particle swarm optimization (PSO). Six test models of different communication systems have been developed in Matlab environment and planned two-factor estimation experiments have been performed with them. A comparative analysis of the evaluation results using GA and ORF was performed. The chosen research methodology allows to achieve the set goal and to obtain an adequate answer to the problems solved in the dissertation.

5. Characteristics and evaluation of the dissertation and contributions

Chapter I presents an overview of the current state of the art in parametric and structural optimization of telecommunication component and system models. The methods used and current problems in estimating the parameters and structure of systems using evolutionary algorithms are analyzed. The aim of the dissertation is formulated. Six tasks are set to achieve this goal.

Chapter II describes the research methodology presented above in Section 4.

Chapter III discusses the simulation test models of communication devices and procedures implementing artificial intelligence methods built in Matlab.

Chapter IV presents the results of the numerical experiments performed using Monte Carlo simulation. Tests were performed to estimate using GA and ORF the parameters of: a linear system; an analog bandpass filter with Chebyshev characteristic; a phase-locked loop PLL using a 3rd order filter and a phase-locked loop PLL using a 4rd order filter. The model structure of the cooling system of communication equipment is also evaluated. Conclusions are drawn.

In the Conclusion, the scientific and applied contributions of the thesis are framed, which I consider to be built on reliable material, since the Appendices show very detailed tables with the results of the experiments performed.

6. Evaluation of the publications and personal contribution of the doctoral student

The main content, results and contributions of the thesis are presented in five publications. Three of them are written in English and published in journals refereed and indexed in Web of Science. The other two are in Bulgarian but contain detailed abstracts in English. In one of the publications, PhD student Mag. Sezgin Ismail is the sole author.

I believe that the PhD student's publications on the dissertation reflect well the main contributions he claims. My assessment of the doctoral student's personal involvement in the dissertation research is that it is unquestionable.

7. Abstract

The abstract was prepared according to the requirements of the relevant regulations, and reflects the main results achieved in the thesis.

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

It would be good to apply the results obtained in this dissertation in further practical research. In spite of the recommendation made, I believe that the author has carefully, thoroughly and thoroughly designed his dissertation, and has demonstrated a high level of research presentation that shows a good knowledge of the subject area. The aim and objectives have been achieved. Substantial contributions have been disseminated in scientific forums and are visible in indexed international databases**.**

CONCLUSION

The dissertation work of Mag. Sezgin Ismail contains scientific and applied results that represent an original contribution to science and fully meets the requirements of the Law for the Development of the Academic Staff of the Republic of Bulgaria, the Regulations for its implementation and the Regulations for the Conditions and Procedure for the Acquisition of Scientific Degrees at University of Plovdiv "Paisii Hilendarski". The attached abstract reflects the essence of the research and correctly presents the contributions of the research.

The dissertation shows that the PhD student, Mag. Sezgin Fakhri Ismail, possesses in-depth theoretical knowledge and professional skills in the scientific specialty of "Automation of areas of the intangible sphere (medicine, education, science, administration, etc.)", demonstrating the qualities and skills to independently conduct scientific research.

Taking into account the merits, relevance, importance and usefulness, and the significant amount of research work of my submitted dissertation, I give it **a positive** evaluation and propose the scientific jury **to award to Mag. Sezgin Fakhri Ismail the educational and scientific degree "DOCTOR"** 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.)".

May 20 2023   **Prepared by: ....**

(Prof. PhD Eng. Rumen Popov)