OPINION

on the dissertation of Stella Dimitrova Todorova
on the topic:
"Study of Indexed Matrices and Their Applications"
for awarding the educational and scientific degree "Doctor"
in the professional field: 5.3. "Communication and Computer Engineering"
specialty: "Computer Systems and Technologies"
by Prof. Sotir Sotirov, University "Prof. Dr. Asen Zlatarov," Burgas

Brief Biographical Information

Stella Todorova was born and raised in the city of Burgas. In 2008, she graduated from the Academy of Science and Mathematics "Acad. Nikola Obreshkov." In 2013, Stella Todorova earned a Bachelor's degree in "Informatics and Computer Science," followed by a Master's degree in "Computer Systems and Technologies" from Burgas Free University. Since 2019, she has been a PhD student at the University "Prof. Dr. Asen Zlatarov." Alongside her studies, she actively teaches students, delivering courses such as Discrete Structures, Informatics, Introduction to Programming, and Object-Oriented Programming.

Description of the Dissertation

Stella Todorova's dissertation consists of 113 pages and includes an introduction, four chapters, a conclusion, contributions to the dissertation, a list of 5 publications related to the dissertation, a declaration of originality of the results, and a bibliography of 213 references. The dissertation contains 32 figures and 1 table.

Chapter 1: Introduction to the Theory of Indexed Matrices

This chapter serves as an introduction to the main concept of indexed matrices (IM). The PhD candidate examines the historical development of the idea, starting from its initial introduction in 1984 by Krasimir Atanasov. A brief review of the existing literature on indexed matrices is included, highlighting the main types of IM, their elements, and the operations that can be performed with them.

1.1 A Brief Review of Publications on Indexed Matrices

Here, the PhD candidate reviews publications related to various types of indexed matrices, describing their properties and usage.

1.2 A Brief Review of Applications of Indexed Matrices

This section covers various applications of indexed matrices in fields such as computer science, engineering, and mathematics.

Chapter 2: New Results in the Theory of Indexed Matrices

This chapter focuses on presenting new scientific results achieved during the research. New methods for solving matrix equations with indexed matrices and the properties of determinants and permanents of these matrices are introduced.

2.1 Solving Matrix Equations with Indexed Matrices

The PhD candidate explores various approaches to solving matrix equations, including those with real numbers and intuitionistic fuzzy pairs as elements.

2.2 The Determinant and Permanent of Indexed Matrices

In this section, the PhD candidate examines the properties of the determinants and permanents of indexed matrices, presenting new results and methods for their calculation.

Chapter 3: Representation of Logical Schemes with Indexed Matrices

In this chapter, the PhD candidate explores the application of indexed matrices in automation design and construction in electronics.

3.1 Application of Indexed Matrices in Automation Design and Construction in Electronics

This section demonstrates how indexed matrices can be used to optimize design processes in electronics.

3.2 Conclusions – The conclusions from this chapter summarize the results and make recommendations for future work.

Chapter 4: Study of Indexed Matrices in Digital Signals and Random Processes

In this chapter, the PhD candidate examines the applications of indexed matrices in the field of digital signals and random processes.

4.1 Introduction

This section serves as an introduction to the applications of indexed matrices for digital signal analysis.

4.2 Digital Transmission

Here, methods for digital data transmission using indexed matrices are explored.

4.3 Discrete Signals (Time Quantization)

This part discusses signal discretization and quantization using indexed matrices.

4.4 Representation of Digital Data with Indexed Matrices

This section discusses methods for representing digital data through indexed matrices.

4.5 Description of Random Processes with Indexed Matrices

Here, methods for describing random processes using indexed matrices are examined.

4.6 Conclusions

The conclusions from this chapter summarize the achieved results and their application in digital signal processing and random processes.

Chapter 5: Representation of Indexed Matrices in Excel Tables

In the final chapter, the applications of indexed matrices in spreadsheet processors like Excel are discussed, focusing on their practical use.

The relevance of Stella Todorova's dissertation lies in the innovative nature of her research on indexed matrices and their applications. In the context of the rapidly developing fields of computer science and engineering, the need for efficient methods of data analysis and processing is greater than ever. Indexed matrices offer new ways to represent and manipulate complex data, facilitating problem-solving in various scientific and technical fields.

The dissertation not only addresses the theoretical aspects of indexed matrices but also their practical applications, making the research highly relevant.

Publications Related to the Dissertation

The PhD candidate has presented 5 publications related to the dissertation. Two of them [1*] and [2*] are indexed in Scopus. The first publication: Todorova, S., Bureva, V., & Angelova, N. (2023, July). On the solutions of some equations with index matrices. In Proceedings of the Jangjeon Mathematical Society (Vol. 26, No. 3, pp. 253-258), examines solutions to specific equations with indexed matrices, a key aspect of matrix theory. The second publication is Todorova S. On the solutions of some equations with intuitionistic fuzzy index matrices., Uncertainty and Imprecision in Decision Making and Decision Support _ New Advances, Challenges, and Perspectives - Selected papers from BOS/SOR-2022, held on October 13-15, 2022, and IWIFSGN-2022, held on October 13-14, 2022, in Warsaw, Poland., Springer Nature Switzerland AG. Vol. 26, No. 3, 2023.

The other three publications are in the journal of the Union of Scientists, Informatics section, and in a publication of the Scientific and Technical Union of Mechanical Engineering.

The last two publications, listed as related to the dissertation, are not adequately reflected in the dissertation. The first publication, co-authored by the two supervisors, and to some extent the second publication, make a good impression. However, the last two publications are somewhat unrelated to the dissertation text and do not include at least one of the PhD candidate's supervisors.

The objectives of the dissertation are stated as follows:

1. The primary goal of this dissertation is to find solutions to matrix equations consisting of indexed matrices whose elements are real numbers and intuitionistic fuzzy pairs.

2. Another objective is to study the properties of the determinant and permanent of indexed matrices.

3. Presentation of functional-constructive modules with indexed matrices.

4. Presentation of assembly locations of functional-constructive modules with indexed matrices.

5. Study of random processes with indexed matrices.

6. Application of indexed matrices with the Excel program.

7. Presentation of logical values set by Arduino controller outputs, configured as outputs, with indexed matrices.

The formulation of these objectives is extremely poor and disorganized. In my opinion, some of them should not be included as dissertation objectives (e.g., number 6).

The contributions in the dissertation are also poorly formulated. The first so-called theoretical contribution is promising and could be split into two parts. The remaining contributions are poorly described and unstructured. I do not see how the last two publications in the dissertation relate to any of them or to the dissertation text itself.

Conclusion

In conclusion, I can say that the topic and the dissertation are relevant, and original results have been obtained. The dissertation meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the regulations of the University "Prof. Dr. Asen

Zlatarov." Despite the many unstructured, unformatted, and poorly composed sections of the dissertation, there are a few significant contributions formulated for the first time. For all these reasons, I give my positive opinion on awarding Stella Dimitrova Todorova the educational and scientific degree "Doctor" in the professional field 5.3. "Communication and Computer Engineering," specialty "Computer Systems and Technologies."

08.09.2024

Opinion prepared by:

Подпис заличен
Чл.2 от ЗЗЛД

(Prof. Dr. Sotir Sotirov)