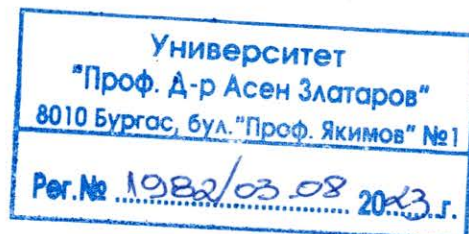


REVIEW



**on the dissertation thesis of Toncho Ivanov Boyukov,
entitled “Generalized nets as tool for modeling railway transport in Bulgaria”
Submitted for awarding the educational and scientific degree “Doctor of
Philosophy” in Professional Area: 5.3. “Communication and Computer
Technique”, doctoral program “Computer systems and technologies”
by Assoc. Prof. Veselina Bureva,
“Prof. Dr. Assen Zlatarov” University – Burgas**

In accordance with order UD №168 of 11.07.2023 г. of the rector of the “Prof. Dr. Assen Zlatarov” University - Burgas I am designated as a reviewer of the dissertation of Toncho Ivanov Boyukov on the topic “Generalized nets as tool for modeling railway transport in Bulgaria”. I want to note that, as a member of the scientific jury, I have received all the documents of the dissertation work. No additional documents or evidence were required in preparing the review.

1. Brief biographical data

From the presented Curriculum Vitae, it is seen that Toncho Boyukov defends master degree in the “Prof. Dr. Assen Zlatarov” University – Burgas in professional area 5.5 Transport, Shipping and Aviation, scientific specialty "Engineering and technologies in transport". He graduated from Ivan Vazov Secondary School, Burgas with specialty “Electrical engineering and electronics”. From April 2002 he was a service engineer at AUTOTECH-G, and from January 2020 he was assistant professor at the Prof. Dr. Assen Zlatarov" University - Burgas.

2. Brief information about the dissertation work

The railway transport optimization is an actual problem that can be modeled to achieve its understanding and provide improvements. Toncho Boyukov's dissertation work is 126 pages' long and consists of six chapters, conclusion containing the contributions of the thesis and directions for future research work, a list of 4 publications on the dissertation thesis, and a bibliography comprising 44 titles.

Chapter 1 is introductory and it formulates the goal and tasks being solved in the thesis. It presents the definitions of the transition and Generalized net and the algorithms for their functioning. The main aim of the dissertation work is the application of Generalized nets for modelling the

processes in the area of railway transport. The final aim of the investigation is to present constructed Generalized net model of the entire railway network of Bulgaria.

The second chapter discusses the new definitions of four extensions of the two-way Generalized Net (TGN): intuitionistic fuzzy two-way generalized net from first, second, third and fourth type.

Chapter 3 presents a constructed two-way generalized net model of the Burgas railway station.

In Chapter 4 are discussed the generalized net models of the of the entire railway transport scheme of Bulgaria: Generalized net model of the railway network of Bulgaria (4.1), Generalized net model of the railway network in Western Bulgaria (4.2), Generalized network model of the railway network in North Central Bulgaria (4.3), Generalized network model of the railway network in South Central Bulgaria (4.4), Generalized network model of the railway network in Eastern Bulgaria (4.5).

Chapter 5 presents Generalized nets models of the main railway networks in Bulgaria and its connections with neighboring countries.

In the chapter 6, the GN-model of the connections between the different types of transport in Bulgaria is described.

The conclusion of the dissertation work summarizes the obtained results and presents future research directions.

The structuring of the dissertation is at a good level.

3. Scientific indicators

Table 1 presents the minimum required points by group of indicators for holding the educational and scientific degree “Doctor of Philosophy” in Professional Area: 5.3. “Communication and Computer Technique”, doctoral program “Computer systems and technologies”.

Table 1 Reference to the fulfillment of the minimum requirements

| <i>Group of indicators</i> | <i>Minimum required points</i> | <i>Points of Toncho Boyukov</i> |
|----------------------------|--------------------------------|---------------------------------|
| <i>A</i> | 50 | 50 |
| <i>B</i> | - | - |
| <i>V</i> | - | - |
| <i>G</i> | 30 | 49,6 |
| <i>D</i> | - | - |
| <i>E</i> | - | - |
| <i>Total:</i> | 80 | 99,6 |

The quantitative indicators of the criteria for obtaining the educational and scientific degree "Doctor", required by the Law on the Development of the Academic Staff in the Republic of

Bulgaria and regulations for the conditions and the order of acquiring scientific degrees and holding academic positions at the University "Prof. Dr. Asen Zlatarov" - Burgas are satisfied.

The PhD student's contributions can be summarized as scientific:

1. New definitions of four extensions of the two-way Generalized Net (TGN): intuitionistic fuzzy two-way generalized net from first, second, third and fourth type.
2. Two theorems presenting that „The functioning and the results of the two-way generalized net can be represented by the standard generalized nets“.
3. Construction of the two-way generalized net model of the Burgas railway station.
4. Construction of the generalized net models of the of the entire railway transport scheme of Bulgaria: Generalized net model of the railway network of Bulgaria, Generalized net model of the railway network in Western Bulgaria, Generalized network model of the railway network in North Central Bulgaria, Generalized network model of the railway network in South Central Bulgaria, Generalized network model of the railway network in Eastern Bulgaria.
5. Constructed Generalized nets models of the main railway networks in Bulgaria and its connections with neighboring countries.
6. Constructed GN-model of the connections between the different types of transport in Bulgaria.

The results of the dissertation work are presented in the following conferences:

- 2022 IEEE 11th International Conference on Intelligent Systems (IS)
- IWIFSGN 2020. International Workshop on Intuitionistic Fuzzy Sets and Generalized Nets. Warsaw. Poland. December 10-11, 2020

The obtained results are published in 4 papers: 2 publications in the international journals and 2 papers in the Annual of Informatics, Section of “Informatics”, Union of scientist in Bulgaria. Two papers have SJR. I will observe that all papers are published in journals and proceedings closely related to the theme of the dissertation thesis.

The abstract correctly reflects the results obtained in the dissertation work.

The discussion for future research works makes good impression.

4. Critical remarks and recommendations

I have the following critical remarks:

- Figure 3.7 is missing.

- The graphic presentation of the two-way two-way generalized net model of the Burgas railway station has inaccuracy – the input and output places should not have arrows.
- The quality of figure. 3.5 (page 34) is not good. Additional clarification is that this is the map used for generalized net model construction.
- It will be good to be clarified at page 36 that two-way generalized net model and subnets are used (figures 3.9, 3.10 и 3.11).
- In the constructed generalized net models in chapter 5 and chapter 6 the description of the transitions is not completed. The type of the transitions is missing; part of the characteristics for input and output places are missing.

I have the following recommendations:

The generalized net models of the of the entire railway transport scheme of Bulgaria makes very good impression. It contains 57 transitions and 197 places. This is the biggest GN model until the current moment.

I recommend that Toncho Ivanov Boyukov continue to conduct research and publish the results in a specialized books and textbooks.

My impressions of Toncho Ivanov Boyukov are very good. I can describe him as an extremely hard-working and purposeful person.

5. Conclusion

The dissertation fulfills the requirements of ZRAS and the Regulations for the terms and conditions for acquiring scientific degrees and holding academic positions at the “Prof. Dr. Assen Zlatarov” University. All of the above justifies my confident positive evaluation of the dissertation thesis and the materials presented alongside, and to recommend the honourable members of the Scientific Jury to vote for awarding Toncho Ivanov Boyukov the educational and scientific degree “Doctor of Philosophy (PhD)” in Professional Area 5.3 “Communication and Computer Technologies”, Scientific Specialty “Computer Systems and Technologies”.

04 August 2023 г.
Burgas, Bulgaria

Opinion written by:

(Assoc. Prof. Veselina Bureva, PhD)

Подпис заличен
Чл.2 от ЗЗЛД