OPINION

from Idilia Alexandrova Batchkova, Professor, PhD, UCTM - Sofia, Dept. "Industrial Automation", idilia@uctm.edu, member of the Scientific Jury

on the dissertation thesis for obtaining an educational and scientific degree "Doctor" in the Doctoral Programme "Application of the principles and methods of cybernetics in various fields of science", Professional Area 5.2. "Electrical engineering, electronics and automation", with author **Mag. Eng. Yordanka Lyubomirova Boneva** titled:

"Traffic optimization of in urban environments"

1. Relevance of the developed problem

Traffic in the urban environment is a major and difficult problem for modern society, associated with waste of time, rising travel costs, environmental pollution and others. The task of optimizing traffic in an urban environment is an extremely important task, the solution of which will lead to dealing with the above problems. All this defines the problem considered in the dissertation thesis as important and relevant, requiring knowledge in two modern areas - transport systems and methods, and tools for modeling and optimization.

2. Does the PhD student knows the current state of the problem and creatively evaluates the references

The current state of the scientific problem considered in the dissertation is based on the analysis of 122 references, of which 66 are references from the last 10 years. 31 references of Bulgarian authors are also cited, 12 of which are publications in English.

The PhD student has presented in detail and correctly the advanced and basic concepts in traffic control, as well as various models for traffic control in the city network. The review ends with conclusions. I believe that the analysis presents a complete and correct picture of the researched problem and is a good basis for defining the purpose and tasks of the dissertation.

3. Can the chosen methodology give an answer to the set goal and tasks in the dissertation

In the Introduction of dissertation the purpose of dissertation is formulated, which is related to the development of a mathematical model for solving the problem of optimizing road traffic in urban transport network. For this purpose, a methodology related to solving the following sequence of 6 tasks is proposed: 1) Development of a mathematical model of an urban transport network. 2) Development of a hierarchical model for control of a network of intersections; 3) Defining and solving hierarchical optimization problems; 4) Building a computer model and simulations in the AIMSUN software package; 5) Testing

of results without and with data from the solved optimization problem in AIMSUN simulation environment; 6) Evaluation of the obtained solutions by comparison with TRANSYT - a software product that is used worldwide for evaluation of management strategies in the field of road traffic.

I believe that the chosen research methodology ensures the solution of the set tasks, guaranteeing the reliability of the obtained results and determines the achievement of the goal of the dissertation thesis.

3. Contributions to the dissertation

I evaluate the contributions in the dissertation thesis on scientific-applied and applied ones. I believe that the PhD student has correctly formulated the most significant contributions in the dissertation. To the scientific-applied contributions it is worth noting: 1) It has been created a mathematical model of the object - an urban road network, regulated with light signalization, for the purposes of the object optimization; 2) A bi-level hierarchical optimization problem for optimization of the light signaling of traffic lights and the duration of the cycle has been defined and solved. 3) A comparative analysis of the results of the optimization with results from simulation is done. The applied contributions include: 1) Creating a simulation model of a network of intersections. 2) Extension of the simulation model taking into account the presence of a tram line, permission for parking in a system of transport intersections.

4. Publications on the dissertation thesis

5 publications on the dissertation thesis are presented, of which 4 are independent and 1 in co-authorship with the supervisor. 4 of the publications are in English and 1 - in Bulgarian. 3 of the publications are in proceedings of international conferences and 2 - in scientific journals. 2 scientific papers are indexed in SCOPUS. I believe that the scientific publications reflect the main achievements of the dissertation, and their number satisfies the requirements laid down in the Regulations for the specific conditions for obtaining scientific degrees and for holding academic positions in the IICT of BAS. There are 2 citations of the scientific work published in the scientific journal "Mechanics Transport Communications".

5. Opinions, recommendations and notes

Having in mind the urgency of the problem, the achieved scientific-applied and applied contributions in the dissertation thesis, I positively evaluate the dissertation thesis presented to me for an opinion (standpoint), without significant remarks. I recommend the PhD student, in his future work on this task, to pay attention to the use of methods and tools of artificial intelligence, and their combination with conventional ones.

According to the presented reference for fulfillment of the minimum requirements of IICT for the educational and scientific degree „doctor", and the review of the materials accompanying the procedure, Mag. Eng. Yordanka Boneva covers the necessary minimum requirements as follows: 50 points from group A for the development of a dissertation thesis and 130 points from the minimum possible 30 points from group G (sum of indicators from 5 to 11).

6. CONCLUSION

My assessment of the dissertation thesis, abstract, scientific publications and contributions of **Mag. Eng. Yordanka Boneva is POSITIVE**. The presented dissertation thesis fully meets the requirements set out in the Law on Acquisition of Scientific Degrees and Occupation of Academic Positions in BAS, as well as the Regulations on the Specific Conditions for Acquisition of Scientific Degrees and Occupation of Academic Positions in IICT of BAS on in terms of volume, quality, degree of novelty, scientific contributions and publications. In conclusion, I propose to the esteemed Scientific Jury to award **Mag. Eng. Yordanka Lyubomirova Boneva** educational and scientific degree **"DOCTOR"** in the Doctoral Programme "Application of the principles and methods of cybernetics in various fields of science", Professional Area 5.2. "Electrical Engineering, Electronics and Automation".

Sofia, 14 February, 2021

Author of the Opinion: ....

/Prof. Dr. Idilia Batchkova/