

OPINION

**on the dissertation thesis of Bistra Yulianova Zaharieva
titled “Intelligent Methods for Analysis of Rehabilitation Processes”
for acquiring the educational and scientific degree
“Doctor of Philosophy (Ph.D.)”
in professional field: 5.2. “Electrical Engineering, Electronics and
Automation”, Ph.D. program 02.21.10 “Application of the principles and
methods of cybernetics in different fields of science”**

1. From the presented biography, it is seen that Bistra Zaharieva was born on June 6, 1988. In 2015, she graduated from the Vassil Levski National Sports Academy with specialty Kinesitherapy. From 2012 to 2016 she worked at Spectrum Medical Centre, Sofia.

2. Bistra Zaharieva's dissertation work consists of 148 pages and comprises an Introduction, four chapters, a Conclusion, a Summary of the obtained results, a list of 6 publications on thesis, and a Bibliography of 155 items.

The dissertation thesis is devoted to the application of two mathematical methods for modeling and analysis of rehabilitation processes.

Without dwelling on the content in particular, I will outline the most important contributions and inaccuracies in the dissertation thesis. The first chapter completely comprises a literary review. It is devoted to the intelligent methods for analysis of complex systems. Some of the most significant inaccuracies are the following: John von Neumann and Oscar Morgenstern are creators of game theory and not that of decisions (page 8); between the words “intuitionistic” and “generalized networks” must stay the word “fuzzy”, as omitted on page 30; in the Bulgarian language the gender of the word “component” is only male (see page 31); the number of upper indices in the indexed matrix on page 35 should be n and not q . The most important mistake noticed is related to references not only in this but also in the following chapters. In about 50% of the cases, the reference numbers of the cited references in the text do not match those listed in the Bibliography. The second chapter is devoted to the analysis of rehabilitation processes in the cases of ankylosing spondyloarthritis and chronic degenerative disease of the knee joint - a field of science which I am not competent, and therefore I will not comment on. In the third chapter, the intercriteria analysis is applied over numerical results obtained after a kinesitherapeutical treatment course. As one of the inventors of this mathematical tool, I am, of course, pleased to see it has been used in a dissertation thesis, but I cannot but point out that this analysis makes it possible to draw also other conclusions regarding the criteria on which data are available, other than those set forth in the text. For example,

one can determine which criteria are independent of one another, something that has not been done in the thesis. This chapter also describes two generalized net models. In my opinion, they are quite complete and adequately describing the modeled kinesotherapy processes. There are several inaccuracies and omissions in the models. For example, in the description of predicates of the index matrix of the sixth transition of the first generalized net (page 96), it is stated how the modeling process develops, if any parameter is in the interval $[0, 3]$ or in the interval $[3, 5]$, but it is unclear what will happen if this parameter is less than 0 or greater than 5. It is not clear how the eighth transition in the second generalized net (page 109-110) should function if the two indicated predicates (equal to each other) are not evaluated true. The fourth chapter is devoted to ethical norms in the application of intelligent methods of analysis of rehabilitation processes - another field of science that I am not competent, and therefore I will not comment on. Despite these inaccuracies, the dissertation thesis has been precisely formatted, of course, with the exception of references which, as I have already stated, are in their majority incorrectly numbered.

3. The synopsis reflects the contents of the dissertation thesis and corresponds to the requirements of the Academic Staff Development Law, and the Regulations for the conditions and order for acquiring academic degrees and for occupying academic positions at the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences.

4. The attached report indicates that Bistra Zaharieva is coauthor of six publications related to her dissertation thesis, four of which in two international journals published in Bulgaria, one with SJR factor, one in a Polish journal and one paper in an international IEEE conference, held in Madeira. These publications meet the requirements of the Regulations on the Terms and Procedure for Acquisition of Academic Degrees and the Occupying of Academic Jobs at the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences.

All of the above is a reason for me to give a positive evaluation of the thesis and the accompanying materials, and to recommend the respectable members of the Scientific Jury to vote for awarding Bistra Yullianova Zaharieva the educational and scientific degree "Doctor of Philosophy (Ph.D.)" in the professional field 5.2. "Electrical Engineering, Electronics and Automation", Ph.D. program 02.21.10 "Application of the principles and methods of cybernetics in different fields of science".

20 January 2019

Signature:

(Corr. Member Prof. Krassimir Todorov Atanasov, DSc DSc)