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Rakovski National Defence College

REPORT

by Assoc. Prof. Ivo Rumenov Draganov, PhD
*(academic post, scientific degree, name, surname and family name
of the member of the scientific jury)*
Technical University - Sofia
(affiliation of the member of the scientific jury)

of the PhD thesis of Yoana Atanasova Ivanova

(name, surname and family name of the PhD thesis' author)

with title „Research of the impact of cyberattacks on a transport management system“,

submitted for obtaining the PhD degree (DSe-degree)

in the specialty "Automated Information Processing and Control Systems"

The member of the jury answers the following questions and requirements:

1. Relevance and importance of the scientific problem being solved.

Cyber attacks on modern information and management systems could have extremely negative effects on the critical infrastructure of entire industries or the state as a whole. The results of their implementation can have lasting effects on the lives of large groups from the society and, as a result, their research and systematic presentation are the first step in the overall process of counteracting them, which defines the topics presented in the dissertation extremely relevant. Research in the field over the last 5-6 years has been very active and some key publications on it are: Petit, J., S. E. Shladover, Potential cyberattacks on automated vehicles. *IEEE Transactions on Intelligent Transportation Systems*, 2014, 16.2: 546-556; Dellios, K., D. Papanikas, D. Polemi, Information security compliance over intelligent transport systems: Is it possible? *IEEE Security & Privacy*, 2015, 13.3: 9-15; Cerrudo, C., An emerging US (and world) threat: Cities wide open to cyber attacks. *Securing Smart Cities*, 2015; 17: 137-151. Most of them treat the problem globally worldwide or nationally. In our country the presented research could be characterized as unique as it treats the problem from a very technical and operational point of view on a certain type of transport management system. The main content of the development is related to modeling the impact of cyberattacks on a transport management system and as such it is relevant to the topic of the dissertation. Positive aspects of the dissertation are the analytical features, which are summarized after the analysis of the vulnerabilities and the impact of cyber threats on the transport management systems. The summarized assessments based on simulation results of the impact of cyber attacks on a specific section of an urban automobile transport system and the overall methodology for assessing the vulnerability of a management system of this type by risk prediction, diversified through the use of two methods, are another two components of its high qualities. The recommendations made on the basis of all the results obtained would be a valuable starting point in the integral approaches to improve the reliability and security of transport management information systems.

2. Evaluation of the scientific results and contributions of the thesis.

The contribution of the PhD student's work to the scientific community can be highlighted in the development of a model for the link between the conceptual structure of the cyber threat triangle and the technical simulation tools to reduce cyber vulnerabilities, synthesizing and optimizing the model of the Traffic Control Center applicable in simulation software environments, as well as the development of algorithms for systematic cyber threats research in an attempt to find potential damage to the critical infrastructure. The manner of consistent and in-depth presentation of all the main results in the dissertation, together with the technological way of their obtaining, is a clear indicator of the author's participation, which is also evident from research-related publications.

3. Opinion on the presence or absence of plagiarism.

There are no known works by other authors who, in their content, present the results declared by the author of the dissertation. Baseline relations, basic models, and link elements that underpin the field of interest are presented by citing relevant, current, references.

4. Critical notes.

One of the aspects that the PhD candidate could take into consideration in shaping better the results of her future research is the shorter and synthesized exposition of the generalized characteristics of the studied objects and processes, accompanied by brief conclusions and directions for the future development of the system components. In this sense, the volume of the work presented could be smaller and the large figures representing large-scale models could be presented in a separate annex.

The presented list of scientific contributions, which is undoubtedly sufficiently detailed and correct in content, could be expanded to 3 or 4 points, summarizing the contributions separately for each chapter.

5. Conclusion.

The dissertation presented contains an analysis of the current state of the problems of studying cyber attacks on systems of critical infrastructure and related models already built. An adaptive expression of the most successful ones has been carried out to assess the impact of cyber attacks on a specific type of transport management system and possible mitigation aspects have been identified. All theoretical models, which were subjected to optimization procedures during the study, are supported by experimental results based on software simulations and a summary of the obtained quantitative parameters. These naturally follow the conclusions the PhD student makes at the end of each chapter of the thesis. All the main results of it are presented in 3 scientific

publications - 2 in the International Journal of Information Technologies and Security and 1 in the Yearbook of the Military Academy with the candidate as a sole author.

The volume, structure and content, together with the way of presenting qualitative and quantitative parameters and summaries on their basis in the researches presented in the dissertation work and the related publications, fully meet the requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria and the Regulations for its application for the PhD degree.

6. Evaluation of the thesis.

Based on the above considerations, I give a positive assessment of the dissertation work of Yoana Atanasova Ivanova with a title "Research of the impact of cyberattacks on a transport management system" in the scientific specialty "Automated systems for information processing and control" in professional field 5.3. "Communication and Computer Engineering" and I support the acquisition of the PhD degree by the applicant.

Date: 26.2.2020

Reviewer:
(signature)