

OPINION

**by Veselina Kuncheva Bureva
from "Prof. Dr. Assen Zlatarov" University
on the Thesis of Ivan Dimitrov Torlakov,
entitled "Application of high-performance systems for modelling stability
processes in Cohen-Grosberg type neural networks"
Submitted for awarding the educational and scientific degree "Doctor of
Philosophy" in the doctoral program "Computer systems and technologies",
Professional field: 5.3. "Communication and Computer Technologies"
under the Scientific Field 5. Technical Sciences**

The Opinion was prepared according to Order No. №330 from December 05, 2022 by the Rector of the University "Prof. Assen Zlatarov" - Burgas, Prof. Magdalena Mitkova, Art. 44 of the Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at the University "Prof. Assen Zlatarov"-Burgas, in connection with a decision of the Faculty Council of the Faculty of Technical Sciences for the student Ivan Dimitrov Torlakov for awarding the educational and scientific degree "Doctor of Philosophy" (PhD), with scientific supervisors - Prof. Gani Stamov, DSc and Prof. Stanislav Simeonov, PhD.

As a member of the Scientific Jury I have received:

- 1) Order No. №330 from December 05, 2022, by the Rector of the University "Prof. Assen Zlatarov" - Burgas, Prof. Magdalena Mitkova.
- 2) Abstract of the dissertation for the educational and scientific degree PhD.
- 3) Dissertation for the educational and scientific degree PhD.
- 4) Autobiography of Ivan Dimitrov Torlakov.
- 5) Copies of the publications included in the PhD thesis.

1. From the presented Curriculum Vitae, it is seen that the candidate was born on August 27, 1993. In 2019, he defends master degree in the "Prof. Dr. Assen Zlatarov" University. In 2016 he defends bachelor degree in the Technical University- Sofia, Faculty of engineering and pedagogy of Sliven. From 2014 to 2015, he worked as a technical contractor for Technical University- Sofia, Faculty of engineering and pedagogy of Sliven, from 2017 to 2019 he was web designer in the company Sliven Net, and as of 2019 he has been a programmer in the same company.

2. The dissertation thesis of Ivan Torlakov is 151 pages long and consists of introduction, three chapters, conclusion, a list of 4 publications on the dissertation thesis, and a bibliography comprising 123 titles.

Without elaborating in details the content of the dissertation thesis, I will outline its most significant contributions, in my opinion.

The aim of the dissertation is "to model stability processes in Cohen-Grosberg-type neural networks with bidirectional associative memory with time-varying delays and variable impulsive perturbations, using a high-performance and parallel technique".

To achieve the goal, the following tasks have been formulated:

- To explore existing software solutions for Cohen-Grosberg type bidirectional associative memory or similar neural network model;
- To develop a mathematical model and investigate the stability conditions for a network of two neurons;
- To model the stability conditions of the considered neural network model;
- To develop and implement the classical algorithm for neural networks of the considered model;
- To implement and investigate parallel algorithms for stability conditions of an existing configuration;
- To implement a parallel algorithm based on CUDA;
- To implement a parallel algorithm based on OpenMPI;
- To examine the results and their presentation in view of their volume.

Chapter 1 presents an introduction on the neural network theory. In the second chapter, a mathematical model for the study of qualitative properties of impulse neural networks of the Cohen-Grosberg type is considered. In the third chapter, parallel algorithms for the study of impulse neural networks of the Cohen-Grosberg type are investigated. Declaration of originality missing. The structuring of the dissertation is at a good level.

The synopsis reflects adequately the contents of the dissertation thesis, and meets the requirements of the Academic Staff Development Act of the Republic of Bulgaria.

I accept the contributions formulated by the PhD student.

3. From the applied reference, it is seen that Ivan Torlakov has been the author of 4 publications related to his dissertation thesis. Two of them are in Lecture Notes in Networks and Systems, one paper is from Symposium, one publication is in an international journal with Q2, Mathematics. Three publications are visible in the

international database Scopus. All publications are co-authored. I will observe that all papers are published in journals and proceedings closely related to the theme of the dissertation thesis.

4. I would recommend to add conclusions after each chapter. There are inaccuracies in relation to the dissertation work and the abstract regarding the presentation of the contributions at the end of the materials. There are technical errors in the text.

The requirements of the Law for development of the academic staff in the Republic of Bulgaria and its regulations are fulfilled, as well as of the Regulations for the conditions and the order for acquiring scientific degrees and holding academic positions at the University "Prof. Dr. Asen Zlatarov ". All of the above justifies my 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 Ivan Dimitov Torlakov the educational and scientific degree "**Doctor of Philosophy (PhD)**" in Professional Area **5.3 "Communication and Computer Technologies"**, **Scientific Specialty "Computer Systems and Technologies"**.

Подпис заличен
Чл.2 от ЗЗЈД

27 January 2023

Opinion written by:
(Assoc. Prof. Veselina Bureva, PhD)