Opinion

On a procedure for defense of a dissertation

„Local Properties of Dynamical Systems“

за придобиване на

For acquisition of educational and scientific degree “doctor” (PhD)

from

Candidate: **Margarita Nikolaeva Nikolova,**

Scientific Field: **4. Natural Sciences, Mathematics, and Informatics**

Field of Study: **4.5. Mathematics,**

PhD Field: **„Operations Research “,**

Faculty of Mathematics and Informatics (FMI),

Sofia University “St. Kliment Ohridski”

Review by: **Assoc. Prof., PhD, Nikolay Antonov Ivanov, FMI-SU,**

As a member of the jury, according to order № РД-38-383/12.07.2023 г. form the Rector of the Sofia University.

1. **General characteristics of the dissertation and the presented materials**

   The candidate has presented a complete set of documents for the procedure:

   1. Plea for internal review of the dissertation
   2. Dissertation (in English)
   3. Abstract in Bulgarian
   4. Abstract in English
   5. Declaration of authorship of the dissertation
   6. Reference of the minimal national requirements
   7. Report for admission to internal review
   8. Similarity report
   9. Protocol of originality
   10. Opinion on (non)plagiarism
   11. List of publications
   12. Declarations for equality of contributions by the co-authors
   13. Order for internal review

14. Order of enrollment in doctoral studies

15. Certificate of passed exams

16. Order of unenrollment

17. Internal review

18. Transcript of the meeting of the Probability and Statistics group in connection of the pre-defense

19. Diploma for Master's degree

20. Diploma for Bachelor's degree

21. Autobiography

22. A note for the system "Avtorite"

The presented dissertation "Local Properties of Dynamical Systems" has volume of 60 pages and is written in English. It consists of a total of six chapters, with the first being introductory and the last being conclusion. The bibliography contains 52 titles.

2. Personal data and personal impressions about the candidate

Margarita Nikolaeva Nikolova is born on 15.11.1990 in Pleven. In 2009 she graduated from the high school.

In 2013 she obtained her Bachelor's degree in Applied Mathematics from FMI of Sofia University, and in 2018 she obtained her Master's degree in Applied Mathematics. During the period 2018-2022 Margarita was a PhD student in the doctoral program "Operations Research" under prof. M. Krastanov.

I've known Margarita since she enrolled in PhD studies. She is an excellent mathematician and an excellent teacher.

The topic of the dissertation is a bit aside from my research interests.

3. In-depth analysis of the candidate's scientific and applied-scientific achievements contained in the submitted dissertation and the publications included in the procedure

The dissertation examines reachable sets and applies a geometric approach to them. When the exponential is applied to a suitable vector field, a trajectory in the reachable set is obtained. If a family of vector fields parametrized by a parameter t and for which a uniform $\boldsymbol{O(t^{\alpha})}$ estimate holds as $\boldsymbol{t \to 0}$, then their commutator (which is also a vector field) can be given an estimate of the same kind. This allows the application of the Campbell-Baker-Hausdorff formula, which is done repeatedly in the dissertation.

4. Approbation of the results

The dissertation is based on the following publications:

M. I. Krastanov, M. N. Nikolova, A necessary condition for small-time local controllability, Automatica, 2020

M. I. Krastanov, M. N. Nikolova, A sufficient condition for small-time controllsbility of a polynomisl control system, Comptes rendus de l'Academie bulgare des Sciences, 2020, vol 73, issue 12 pages 1638-1649

M. I. Krastanov, M. N. Nikolova, On small-time local controllability, Systems & Control Letters, 2023, vol 177

The results have been presented in several conferences in Bulgaria.

The dissertation contains scientific results that are an original contribution to science.

In the following table, it is demonstrated that the minimal scientometric requirements are met:

Indicator	Min number of points	Points of the candidate
Dissertation	50	50
Publications	30	171

There is no plagiarism, proven by law, in the submitted dissertation under this procedure.

5. Quality of the abstract

The version of the abstract in Bulgarian contains 39 pages and cites 38 titles. The English version contains 37 pages and cites 38 titles. The abstract adequately presents the results of the dissertation.

6. Critical notes and recommendations

I don't have any critical notes.

7. Conclusion

Having read the dissertation under this procedure myself, having examined the accompanying publications, and based on analysis of their significance and scientific contributions they contain, **I confirm** that the presented dissertation and scientific publications with it, as well as the quality and the originality of the results and achievements presented in them, meet the requirements of LDASRB, the Regulations of SU "St. Kliment Ohridski" for the candidate's acquisition of educational and scientific

degree **"doctor"** (PhD) in scientific field 4. Natural sciences, Mathematics, and Informatics and field of study 4.5 Mathematics.

Based on the above, **I recommend** the scientific jury to award **Margarita Nikolaeva Nikolova** an educational and scientific degree **"doctor"** (PhD) in scientific field 4. Natural sciences, Mathematics, and Informatics, field of study 4.5 Mathematics, doctoral program "Operations Research".

09.10.2023 г. Opinion by assoc. prof. PhD Nikolay Antonov Ivanov