Short report

**Procedure for receiving educational
and scientific degree "Doctor" (PhD)**

Candidate: Victoria Bencheva-Petrova

Dissertation: Differential Geometry of Timelike surfaces in a
Minkowski 4-space

Scientific area: 4. Natural Sciences, Mathematics and
Informatics

Professional direction: 4.5 Mathematics

Doctor's programme: Geometry and topology

This report is prepared by assoc. prof. Ivan Minchev from the Department of mathematics and informatics, Sofia University "St. Kliment Ohridski", acting as a member of the Scientific Jury according to Order № 191/02.07.2024 г. of the Director of IMI-BAS.

**General characterization of the dissertation
and the presented materials**

The presented dissertation contains 112 pages as main content, divided into two chapters and a list of references with 67 titles, as well as an author's

reference and a list of talks and publications related to the work. These parameters correspond to the commonly accepted minimum requirements of a meaningful dissertation A complete set of the remaining necessary documents is also presented.

Candidate's Bio

Victoria Bencheva-Petrova was born in 1991 Veliko Tarnovo. In 2016 she obtained her Masters's degree from the University of Veliko Tarnovo "St.st. Kiril and Methodius". She worked as an assistantat professor at the Veliko Tarnovo University between 2017 and 2021. Since 2022 she is working in the private sector as a web designer. The candidate has three publications, all of which are related to the dissertation's theme.

Outline of the Candidate's scientific results and achievements

The results, presented in the dissertation, concern classical problems in the area of Differential geometry concerning various aspects of embedded timelike surfaces in a Minkowski 4-space. The dissertation thesis consists of two chapters: I. Fundamental theorems for timelike surfaces in the Minkowski 4-Space; and II. Timelike surfaces of rotational type.

In Chapter I, the author studies timelike surfaces free of minimal points in the four-dimensional Minkowski space. For each such surface she introduces a geometrically determined pseudo-orthonormal frame field and writes the derivative formulas with respect to this moving frame field. Using the integrability conditions, she obtains a system of six functions satisfying some natural conditions. In the general case, she proves a Fundamental Bonnet-type theorem (existence and uniqueness theorem) stating that these six functions, satisfying the natural conditions, determine the surface up to a motion.

In Chapter II, the candidate considers timelike general rotational surfaces in the Minkowski 4-space which are analogous to the general rotational surfaces in the Euclidean 4-space introduced by C. Moore. She studies two types of such surfaces (with timelike and spacelike meridian curve, respectively) and describes analytically some of their basic geometric classes: flat timelike general rotational surfaces, timelike general rotational surfaces with flat normal connection, and timelike general rotational surfaces with non-zero constant mean curvature. She gives explicitly all minimal timelike general rotational surfaces and all timelike general rotational surfaces with parallel normalized mean curvature vector field.

The results are well described and the required distinction between known results and these obtained by the author (and co-authors) is present. The originality of the obtained results is undoubted and they have deservedly served as a base of already published papers.

Critique and Recommendations

It seems that there is no list of citations on the results in the dissertation thesis provided along with the other documents in the procedure.

Conclusion about the Candidate

Having become acquainted with the dissertation presented in the procedure and the accompanying scientific papers and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, I confirm that the dissertation presented and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria as well as the Regulations for the conditions and rules for acquiring Ph.D. degree of Institute of Mathematics and

Informatics and Bulgarian Academy of Sciences for acquisition by the candidate of the scientific degree "Doctor" in the Scientific field: 4. Natural Sciences, Mathematics and Informatics, Professional field: 4.5. Mathematics (Geometry and topology). In particular, the candidate meets the minimal national requirements in the professional field and no plagiarism has been detected in the scientific papers submitted for the competition. Based on the above, **I recommend the Scientific jury to award Victoria Bencheva-Petrova the educational and scientific degree „Doctor"** in the Scientific field: 4. Natural Sciences, Mathematics and Informatics, Professional field: 4.5. Mathematics.

Date: 29.08.2024   Member of SC:

                                                                (Ivan Minchev)