STATEMENT of a PHD thesis

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entitled

COPULAS ON SOBOLEV SPACES AND APPLICATIONS

by Nikolay Kostov Chervenov

presented for obtaining the academic and scientific degree DOCTOR

in professional field : 4.5 Mathematics (doctoral program : Mathematical Modeling and Applications of Mathematics in Economics)

The statement of PHD thesis is based on the criteria's for obtaining academic and scientific degree DOCTOR according to Academic Staff Development in the Republic of Bulgaria Act , the Regulation for the Application of the Act and all the Regulations of Sofia University "St.Kl. Ohridsky" and the Faculty of Mathematics and Informatics.

1.Content of the dissertation.

Proposed dissertation contains 100 pages in total and consists of introduction , three chapters , conclusion (including the main contributions and the corresponding publications related to the thesis) and bibliography, that refers to 69 scientific sources.

The topic of the dissertation is very relevant in theoretical as well applied direction – see for example [49], [11] , [7] , [33] cited in the bibliography. The problems are considered in depth. The proposed thesis is fully corresponding with the requirements of the mentioned laws and regulations.

In the proposed thesis several major issues are considered united by their treatment by Distribution theory :

a) A generalization of the notion of an n-increasing function is made and, considering many examples ,the advantages and benefits coming from this approach are shown.

b) A new class of copulas is constructed as a solution of an appropriate boundary value problem based on a given mixed   partial derivative (of the copula) , which corresponds to the relation between the probability distribution function and the probability density function when considering a multivariate random variable.

c) The Goursat proplem in the unit cube is considered, which formulation and uniqueness in the case n=3,4,… are new and original.

d) The so called Archimedean copulas are considered in details for wich a known main result is easily established, namely that a particular formula defines copulas.

e) The theorem for the smoothness of the solution (by using Fourier transform or by the Banach – Saks theorem) leads in fact to the same conditions (see Remark 2.3.2 from the thesis).

f) Obtained results are used and applied to the reel problem coming from insurance area (Chapter 3 from the thesis).

The list of main problem made also indicates the main scientific achievements in the dissertation.

2.Publications related to the thesis.

Results of the dissertation are published in the following scientific journals : two articles in Serdica Math. J.,two articles in Comptes rendus de l'Academie bulgare des Sciences , and one in AIP Conference Proceedings 2048 from 2018.The last two journals are in databases Scopus and Web of Sciences.

The chapter 3 of the thesis corresponds to a preprint which is in process of preparation.Despite the presence of co-authors , Mr.Chervenov has shown that he has played an essential part in the process of dealing with various problems which indicates his role in the publications.

Papers are quite recently published which explains the lack of citations.

3. Critical remarks and recommendations.

I would like to point out some possible continuations of this study :

I.   To consider more general spaces instead if Sobolev spaces , this results the obtained solutions to be only continuous and not Hoelder continuous as in the dissertation.
II.   More variety of applications in insurance and finance areas.
III.   To consider maximum non-smooth copulas such that a variant of Sklar's theorem to be still valid (the problem was suggested by prof. Racho Denchev during the dissertation pre-defense).

4. Summary of the PhD thesis.

The Summary of the PhD thesis correctly and fully reflects the content and achievements of the dissertation.

5.Conclution.

I consider the dissertation "Copulas on Sobolev spaces and Applications " as a detailed and in-depth study of main problems in the copula theory. It fully complies with criteria's for obtaining academic and scientific degree DOCTOR according to Academic Staff Development in the Republic of Bulgaria Act , the Regulation for the Application of the Act and all Regulations of Sofia University "St.

Kl. Ohridski "and the Faculty of Mathematics and Informatics.Therefore I recommend to the Honorable Scientific Jury to award Nikolay Kostov Chervenov the educational and scientific degree DOCTOR in the professional field 4.5 Mathematics (doctoral program Mathematical Modeling and Applications of Mathematics in Economics).

08.04.2019   Member of scientific jury :

Sofia   ……………………………………..

                                                          (Iordan Iordanov)