

International
Scientific Conference



Algebraic
and Geometric
Methods
of Analysis

27-30 May 2024
Odesa, Ukraine

The purpose of this conference is to bring together researchers in geometry, topology, algebra, analysis and dynamical systems and to provide for them a forum to present their recent work to colleagues from different nationalities. This way we aim to stimulate discussion about the latest findings in geometrical and topological methods in analysis and to increase international collaboration.

The conference continues the traditional annual conference «Geometry in Odesa» holding from 2004, and hosted by Odesa National University of Technology (Odesa National Academy of Food Technologies till 2021). From 2017 the conference was renamed to «Algebraic and geometric methods of analysis» (AGMA).

The Conference languages: Ukrainian and English.

LIST OF TOPICS

- Algebraic methods in geometry
- Differential geometry in the large
- Geometry and topology of differentiable manifolds
- General and algebraic topology
- Dynamical systems and their applications
- Geometric and topological methods in natural sciences
- Geometric problems in mathematical analysis

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Algebraic periods of surface homeomorphisms

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A self-map $f: M \rightarrow M$ of a compact manifold determines the sequence $\{L(f^n)\}$, $n \geq 1$, of the Lefschetz numbers of its iterations. We consider its dual sequence $\{a_n(f)\}_{n=1}^{\infty}$ given by the Möbius inversion formula. The set $\mathcal{AP}(f) = \{n : a_n(f) \neq 0\}$ is called the set of algebraic periods of f . During the talk we describe finite sets of algebraic periods of homeomorphisms of an orientable surface, especially of Morse–Smale diffeomorphisms.

The talk is based on the joint project with G. Graff, W. Marzantowicz and A. Myszkowski.

Wigner-Ville distribution associated with quadratic Clifford-Fourier transform

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This presentation provides the general double-sided orthogonal $2n-1$ -dimensional spaces split quadratic phase Clifford-Fourier transform and the general Wigner-Ville Distribution quadratic phase Clifford-Fourier transform. It proves the Rènyi and Shannon entropy and Lieb's uncertainty principles.

Keywords: Clifford Algebra; Orthogonal 2D-Planes Split; Clifford-Fourier Transform; Quadratic Phase Clifford-Fourier Transform; Wigner-Ville dDistribution Quadratic Phase Clifford-Fourier Transform.

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Non-simple strongly nilpotent distribution germs

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All known to-date Goursat structures featuring moduli of the local classification appear not to be strongly nilpotent. That is, not being equivalent to their nilpotent approximations. In the course of obtaining more and more (if disparate) confirmations of that statement, like in [1] and [2], a natural problem in the nonholonomic analysis has been gradually imposing by itself: to find a concrete unimodal family of strongly nilpotent completely nonholonomic distributions. The search for such an example seems by now hopeless in the realm of Goursat structures *per se*. Yet, by a

neat perturbation of rank-two Goursat distributions in the underlying dimension 7 we obtain now a 1-parameter family of strongly nilpotent pairwise nonequivalent distribution germs. That family is given in local coordinates that happen to be already adapted. The members of the family are all quasi-homogeneous with respect to the weights defined by the small growth vector, one and the same for all members of the family. This property automatically yields their strong nilpotency, and also facilitates a proof of their pairwise non-equivalence.

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Extending of partial metrics

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A function $p : X^2 \rightarrow [0, +\infty)$ is called a *partial metric* on X if for every $x, y, z \in X$ the following conditions

- (p_1) $x = y \Leftrightarrow p(x, x) = p(x, y) = p(y, y)$;
- (p_2) $p(x, x) \leq p(x, y)$;
- (p_3) $p(x, y) = p(y, x)$;
- (p_4) $p(x, z) \leq p(x, y) + p(y, z) - p(y, y)$.

are true.

For any partial metric $p : X^2 \rightarrow [0, +\infty)$ the function $q_p : X^2 \rightarrow [0, +\infty)$, $q_p(x, y) = p(x, y) - p(x, x)$, is a quasi-metric on X and the topology of the partial metric space (X, p) is the topology τ_q of the quasi-metric space (X, q_p) . Moreover, the function $d_p : X^2 \rightarrow [0, +\infty)$, $d_p(x, y) = 2p(x, y) - p(x, x) - p(y, y)$ is a metric on X .

The following theorem was proved by F. Hausdorff in 1930.

Theorem 1. *Let X be a metrizable space, $A \subseteq X$ be a closed subset and $d_A : A^2 \rightarrow \mathbb{R}$ be a compatible metric on A . Then there exists a compatible metric $d : X^2 \rightarrow \mathbb{R}$ on X such that $d|_{A^2} = d_A$.*

Problem 2. Let X be a partial metrizable space, $A \subseteq X$ be a closed subset and $p_A : A^2 \rightarrow \mathbb{R}$ be a compatible partial metric on A . Does there exist a compatible partial metric $p : X^2 \rightarrow \mathbb{R}$ on X such that $p|_{A^2} = p_A$?

Proposition 3. *Let (X, p) be a partial metric space. Then the function $f : X \rightarrow \mathbb{R}$, $f(x) = p(x, x)$, is an 1-Lipschitz function with respect to the metric d_p .*

Proposition 4. *Let (X, d) be a metric space and $f : X \rightarrow [0, +\infty)$ be an 1-Lipschitz function. Then the function $p : X^2 \rightarrow \mathbb{R}$,*

$$p(x, y) = \frac{1}{2}(d(x, y) + f(x) + f(y)),$$

is a partial metric on X such that $d = d_p$ and $p(x, x) = f(x)$ for every $x \in X$.

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