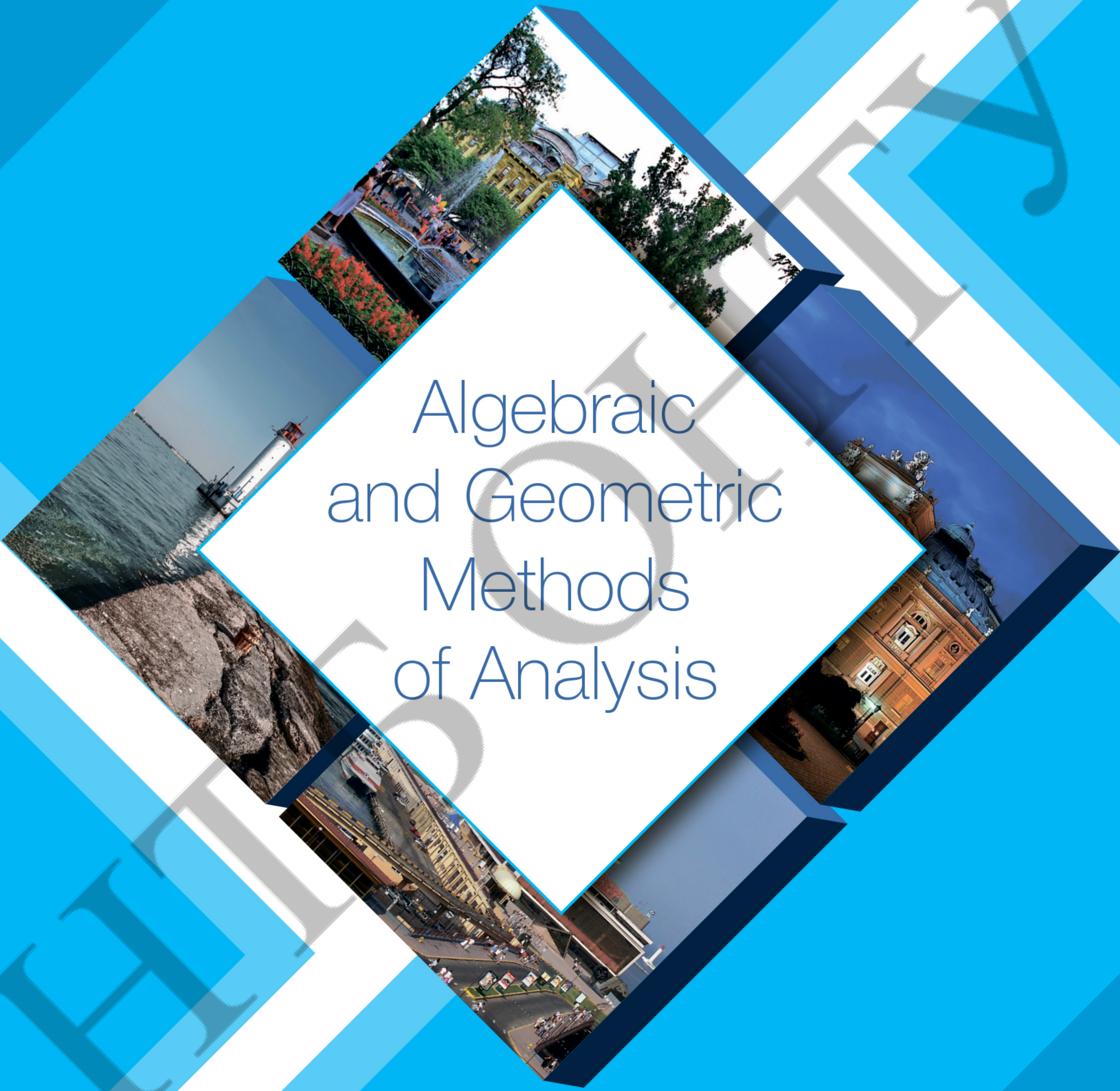
International
Scientific Conference



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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Hypercyclicity of symmetric composition operator

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The classical Birkhoff theorem (1929) [1] asserts that any operator of composition with translation

$$x \mapsto x + a,$$
$$T_a \colon f(x) \mapsto f(x+a)$$

is hypercyclic on the space of entire functions $H(\mathbb{C})$ on the complex plane $\mathbb{C}$ if $a \neq 0$. A generalization of the Birkhoff theorem was proved by Godefroy and Shapiro in [2].

Definition 1. Let X be a topological space. A continuous linear operator $T : X \to X$ is said to be *hypercyclic* if there is some vector $x \in X$ such that the set

$$\mathrm{Orb}(T, x) = \{x, Tx, T^2x, \ldots\}$$

of iterates of x is dense in X. The vector x is called a hypercyclic vector associated to the hypercyclic operator T.

The hypercyclicity of a special operator on an algebra of symmetric analytic functions on ℓ_1 was proved in [3]. We construct new class of hypercyclic composition operators on an algebra of symmetric analytic functions on ℓ_1.

References

[1] G.D. Birkhoff, *Démonstration d'un théorème élémentaire sur les fonctions entières*, C. R. Acad. Sci. Paris **189** : 473–475, 1929.

[2] Godefroy G. and Shapiro J.H. *Operators with dense, invariant, cyclic vector manifolds*, J. Funct. Anal. **98** : 229–269, 1991.

[3] Z. Novosad, A. Zagorodnyuk, *Polynomial automorphisms and hypercyclic operators on spaces of analytic functions*, Archiv der Mathematik **89**(2) : 157–166, 2007.

On (i, j)-Baire Bilocales

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ABSTRACT: In the category of bitopological spaces, a bitopological space (X, τ_1, τ_2) is said to be *almost* (i, j)-*Baire* [1] if every sequence $\{G_n : n \in \mathbb{N}\}$ of τ_j-open τ_i-dense subsets of X satisfies the condition that $\bigcap_{n\in\mathbb{N}} G_n$ is τ_i-dense, where $i, j = 1, 2$, $i \neq j$. In this talk, we transfer this notion of almost (i, j)-Baireness to bilocales. In our notion though, the prefix "almost" is dropped. So, we define and characterize (i, j)-Baire bilocales. We also give internal properties of (i, j)-Baire bilocales which are not translated from properties of almost (i, j)-Baireness in bitopological spaces. For instance, we show that in the class of Noetherian bilocales, (i, j)-Baireness of a bilocale

coincides with (i, j)-Baireness of its ideal bilocale. We also consider relative versions of (i, j)-Baire where we show that a bilocale is (i, j)-Baire only if the subbilocale induced by the Booleanization is (i, j)-Baire.

References

[1] Irakli Dochviri. On submaximality of bitopological spaces. *Kochi J. Math*, 5 : 121–128, 2010.

Application of the dynamical system theory for counting black hole entropy of microstates

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Superstring theory is one of the most advanced theories in physics that attempts to unify all four fundamental forces of nature into one single theory. It is based on the idea that all elementary particles and forces in nature can be explained as vibrations of ultramicroscopic strings. Mathematical models in superstring theory have their own unique properties and applications. They make it possible to describe various physical phenomena and processes, such as gravity, electromagnetism, strong and weak nuclear interactions. One of the main properties of mathematical models in superstring theory is their geometric nature. They describe spacetime as a multidimensional space in which strings can move. This allows us to explain many properties of space-time, such as its curvature and topology. The use of mathematical models in superstring theory also makes it possible to study various physical phenomena and processes. For example, they can be used to describe the processes of birth and decay of elementary particles, as well as to explain the properties of black holes and other exotic objects. For example, the Schwarzschild model is used to describe the gravitational field of a black hole

$$ds^2 = -\left(1 - \frac{2MG}{r}\right)dt^2 + \frac{1}{\left(1 - \frac{2MG}{r}\right)}dr^2 + r^2 d\Omega_2^2.$$

This model allows us to describe the properties of a black hole, such as its radius, r, mass, M. Quantum gravity models are also used to explain the properties of black holes. For example, the loop quantum gravity model allows us to describe the properties of black holes at the microscopic level.

Combining quantum mechanics and thermodynamics leads to many hidden degrees of freedom that give a black hole its entropy. These degrees of freedom do not appear in the classical description of black holes and are associated with string theory. The entropy of a black hole from string theory was calculated by Susskind [1]. The calculations of the string entropy is realized through the consideration of a multidimensional lattice of points with the strings inside it, which can move in any of 2d directions. So, the string entropy is

$$S = ln(2d)^n = n \cdot ln2d.$$

Let us consider the use of mathematical models in the aspect of the theory of dynamical systems through the concept of topological entropy to describe chaotic behavior in dynamics, [2]. One can calculate the volume entropy of such space, B,

$$h_v \sim log(VolB)) \sim log(2d)^n.$$