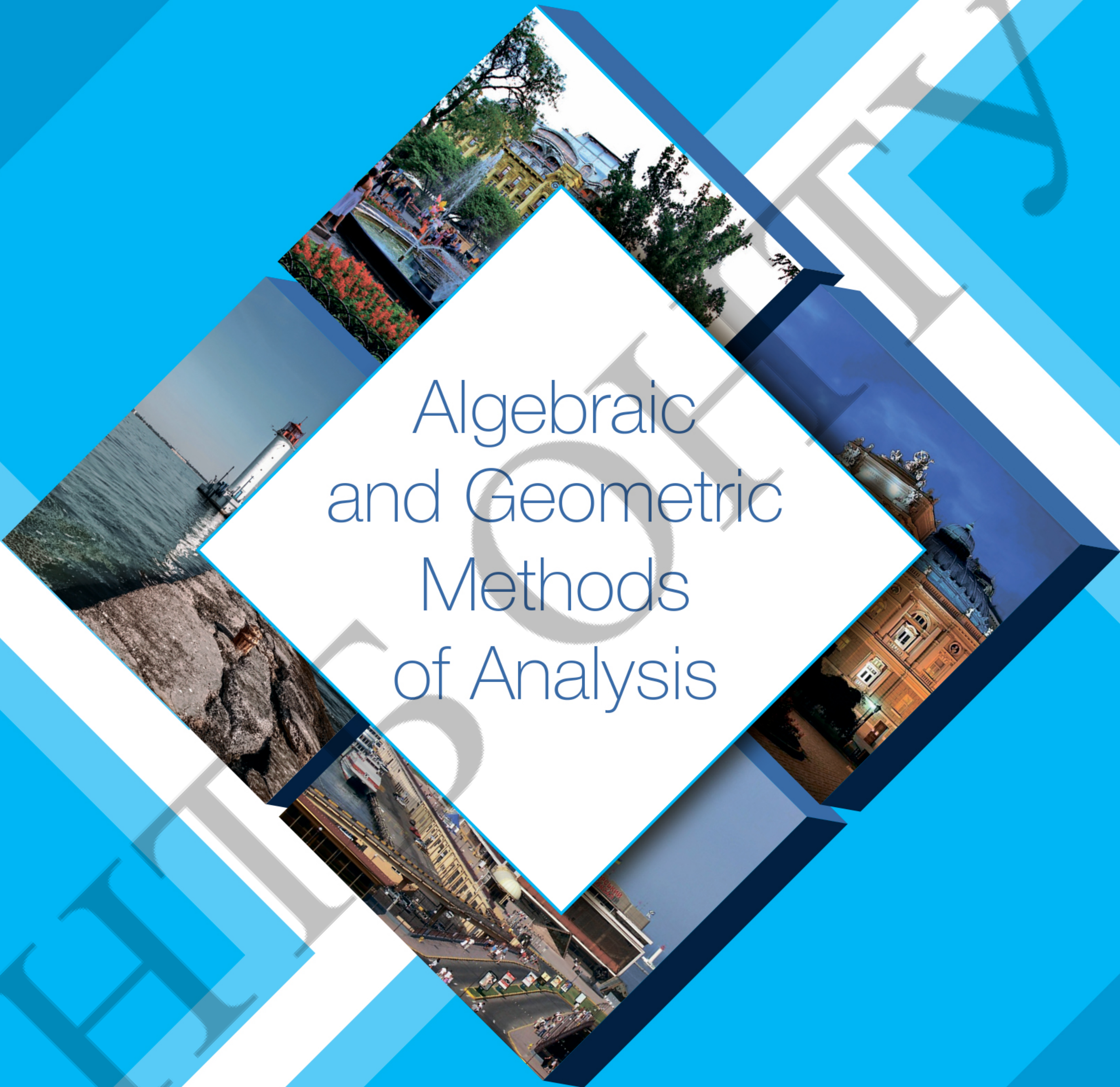
International
Scientific Conference



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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Interestingly, this relation is actually an isomorphism between Δ_Q and the autotopism group of $(Q, \cdot)$.

Theorem 12. *For an (α, β, γ)-inverse quasigroup $(Q, \cdot)$ that is semi-symmetric, $(\Delta_Q, \otimes)$ and $ATP(Q)$ are isomorphic i.e $\Delta_Q \cong ATP(Q)$.*

References

[1] R. Ilemobade, O. George and T.G. Jaiyeola. On the universality and isotopy-isomorphy of (r, s, t)-inverse quasigroups and loops with applications to cryptography. *Quasigroup and Related Systems*, 31: 53–64, 2023.

[2] T.G. Jaiyeola. *A study of new concepts in smarandache quasigroups and loops*, ProQuest Information and Learning(ILQ), Ann Arbor, USA, 2009.

[3] A. D. Keedwell. Crossed-inverse quasigroups with long inverse cycles and applications to cryptography. *Australas. J. Combin.*, 20: 241–-250, 1999.

[4] A. D. Keedwell and V. A. Shcherbacov. On m-inverse loops and quasigroups with a long inverse cycle. *Australas. J. Combin.*, 26: 99–-119, 2002.

[5] A. D. Keedwell and V. A. Shcherbacov. Construction and properties of (r, s, t)-inverse quasigroups I. *Discrete Math.*, 266: 275–-291, 2003.

[6] A. D. Keedwell and V. A. Shcherbacov. Construction and properties of (r, s, t)-inverse quasigroups II. *Discrete Math.*, 288: 61–-71, 2004.

[7] A.D. Keedwell and V.A. Shcherbacov. Quasigroups with an inverse property and generalized parastrophic identities. *Quasigroups and Related Systems*, 13: 109–124, 2005.

[8] Y.T. Oyebo, T. G. Jaiyéọlá and J. O. Adeniran. A study of the holomorphy of (r, s, t)-inverse loops, *Journal of Discrete Mathematical Sciences & Cryptography*, 26(1): 67–-86, 2023. https://doi.org/10.1080/09720529.2021.1885810

[9] V. A. Shcherbacov. *Elements of quasigroup theory and applications*, Monographs and Research Notes in Mathematics. CRC Press, Boca Raton, FL, 2017.

[10] A.R.T. Solarin, J.O. Adeniran, T.G. Jaiyeola, A.O. Isere and Y.T. Oyebo. *Some varieties of loops (Bol-Moufang and non-Bol-Moufang types).* In: Hounkonnou, M.N., Mitrović, M., Abbas, M., Khan, M. (eds) Algebra without Borders – Classical and Constructive Nonassociative Algebraic Structures. STEAM-H: Science, Technology, Engineering, Agriculture, Mathematics & Health. Springer, Cham. 2023. https://doi.org/10.1007/978-3-031-39334-1_3

About Rolewicz theorem on inversion of continuous bijection between F-spaces

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Well-known result of Stefan Banach states that if X and Y are F-spaces and $f : X \to Y$ is a bijective additive continuous mapping, then the inverse mapping $f^{-1} : Y \to X$ is continuous. In general case the inverse mapping can be everywhere discontinuous.

In article [1] Stefan Rolewicz presented sufficient conditions on spaces X and Y under which the inverse mapping to a continuous bijection belongs to the first Baire class.

Theorem 1 (Rolewicz, 1958)**.** *Let X, Y be F-spaces and let X be separable locally compact. Then for every continuous bijection $f : X \to Y$ the inverse mapping $f^{-1} : Y \to X$ is Baire 1.*

The aim of this talk is a discussion of possible generalizations of the above mentioned result of Rolewicz on spaces X which are not linear. In order to do this we introduce a notion of weak Rolewicz space and prove the auxiliary fact about uniform limit of Baire 1 functions which is of self contained interest and extends corresponding results from [2].

Definition 2. A metric space (X, d) is called a *weak Rolewicz space*, if there exist $C > 0$, a sequence $(\varepsilon_n)_{n=1}^{\infty}$ of positive reals which tends to zero and a sequence $(R_n)_{n=1}^{\infty}$ of functions $R_n : X \times X \to X$ such that for all $x, y \in X$

(1) if $d(x, y) \le \varepsilon_n$, then $R_n(x, y) = x$,
(2) $d(R_n(x, y), y) \le C \cdot \varepsilon_n$ for $n = 1, 2, \ldots$.

Every convex subset of a metric vector space is an example of a weak Rolewicz space. Moreover, there are zero dimensional examples of Rolewicz spaces.

Proposition 3. *If Y is a weak Rolewicz space, then a uniform limit $f : X \to Y$ of a sequence of Baire 1 functions $f_n : X \to Y$ belongs to the first Baire class.*

The next theorem is the main result of the talk.

Theorem 4. *Let X, Y be metric spaces and X is locally compact weak Rolewicz space. Then for every continuous bijection $f : X \to Y$ the inverse mapping $f^{-1} : Y \to X$ is Baire 1.*

References

[1] Stefan Rolewicz. On inversion of non-linear transformations, *Studia Mathematica*, 17 : 79–83, 1958.
[2] Olena Karlova, Mykhaylo Lukan, R-spaces and uniform limit of sequences of the first Baire class, *Bukovinian Mathematical Journal*, 7 (2) : 39–47, 2019.

On boundary controllability problems for the heat equation with variable coefficients on a half-axis

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Consider the control system for the heat equation on a half-axis:

$$w_t = \frac{1}{\rho}\,(k w_x)_x + \gamma w, \qquad x \in \mathbb{R}_+,\ t \in (0, T), \tag{1}$$

$$\left(\sqrt{k/\rho}\, w_x\right)\Big|_{x=0} = u, \qquad t \in (0, T), \tag{2}$$

$$w(\cdot, 0) = w^0, \qquad x \in \mathbb{R}_+, \tag{3}$$

where $\mathbb{R}_+ = (0, +\infty)$; T is a positive constant; ρ, k, γ, w^0 are given functions; $u \in L^\infty(0, T)$ is a control. We assume ρ and k are positive on $[0, +\infty)$, $\rho, k \in C^1[0, +\infty)$, $(\rho k) \in C^2[0, +\infty)$, $(\rho k)'(0) = 0$, and

$$\sigma(x) = \int_0^x \sqrt{\rho(\mu)/k(\mu)}\, d\mu \to +\infty \qquad \text{as } x \to +\infty.$$

Moreover, we assume

$$(Q_2(\rho, k) - \gamma) \in L^\infty(0, +\infty) \bigcap C^1[0, +\infty) \qquad \text{and} \qquad \sigma\sqrt{\rho/k}\,(Q_2(\rho, k) - \gamma) \in L^1(0, +\infty),$$