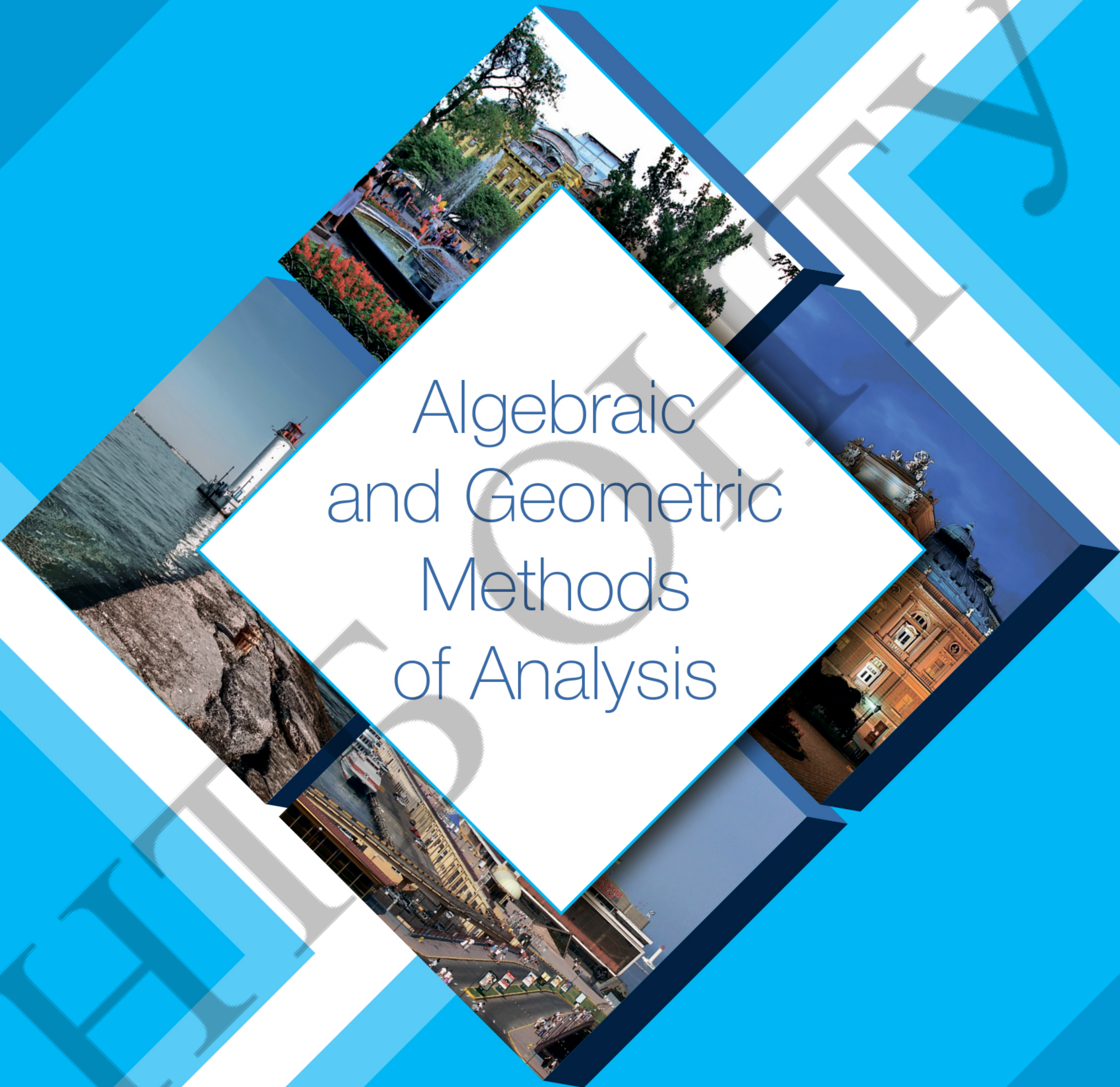
International
Scientific Conference



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

Organizers

- Ministry of Education and Science of Ukraine
- Odesa National University of Technology, Ukraine
- Institute of Mathematics of the National Academy of Sciences of Ukraine
- Taras Shevchenko National University of Kyiv
- Kyiv Mathematical Society

Scientific Committee

- **Vladimir Balan** (*Bucharest, Romania*)
- **Taras Banakh** (*Lviv, Ukraine*)
- **Dmytro Bolotov** (*Kharkiv, Ukraine*)
- **Vyacheslav Boyko** (*Kyiv, Ukraine*)
- **Yulia Fedchenko** (*Odesa, Ukraine*)
- **Oleg Gutik** (*Lviv, Ukraine*)
- **Olena Karlova** (*Chernivtsi, Ukraine*)
- **Volodymyr Kiosak** (*Odesa, Ukraine*)
- **Nadiia Konovenko** (*Odesa, Ukraine*)
- **Volodymyr Lyubashenko** (*Kyiv, Ukraine*)
- **Sergiy Maksymenko** (*Kyiv, Ukraine*)
- **Koji Matsumoto** (*Yamagata, Japan*)
- **Piotr Mormul** (*Warsaw, Poland*)
- **Maryna Nesterenko** (*Kyiv, Ukraine*)
- **Roman Popovych** (*Kyiv, Ukraine*)
- **Alexandr Prishlyak** (*Kyiv, Ukraine*)
- **Aleksandr Savchenko** (*Kherson, Ukraine*)

Organizing commitee

- **Nadiia Konovenko** (*Odesa, Ukraine*)
- **Yuliya Fedchenko** (*Odesa, Ukraine*)
- **Mykola Lysynskiy** (*Kyiv, Ukraine*)
- **Bohdan Mazhar** (*Kyiv, Ukraine*)
- **Sergiy Maksymenko** (*Kyiv, Ukraine*)
- **Alexandr Prishlyak** (*Kyiv, Ukraine*)

On some nonlocal critical equations

Raffaella Servadei
(Universita' degli Studi di Urbino Carlo Bo)
E-mail: raffaella.servadei@uniurb.it

Aim of this talk will be to discuss some existence and multiplicity results for critical nonlocal fractional problems got via variational and topological methods. In particular we will present recent contributions got in the joint paper [1].

Fractional and nonlocal operators appear in various models coming from many different fields. This is one of the reason why, recently, nonlocal fractional problems attracted the interest of the entire scientific community and not just the mathematical one.

References

[1] G. Molica Bisci, K. Perera, R. Servadei and C. Sportelli. Nonlocal critical growth elliptic problems with jumping nonlinearities. *J. Math. Pures Appl.*, 183: 170–197, 2024.

On boundary estimates of mappings, acting onto domains with a locally quasiconformal boundary

Sevost'yanov Evgeny
(Zhytomyr Ivan Franko State University; Institute of Applied Mathematics and Mechanics, Slov'yans'k)
E-mail: esevostyanov2009@gmail.com

Oleksandr Dovhopiatyi
(Zhytomyr Ivan Franko State University)
E-mail: alexdov1111111@gmail.com

Nataliya Ilkevych
(Zhytomyr Ivan Franko State University)
E-mail: ilkevych1980@gmail.com

Maria Androschuk
(Zhytomyr Ivan Franko State University)
E-mail: mariaandroschuk28082003@gmail.com

The following definitions are from [1]. A path γ in $\mathbb{R}^n$ is a continuous mapping $\gamma : \Delta \to \mathbb{R}^n$ where Δ is an interval in $\mathbb{R}$. Its locus $\gamma(\Delta)$ is denoted by $|\gamma|$. Given a family Γ of paths γ in $\mathbb{R}^n$, a Borel function $\rho : \mathbb{R}^n \to [0, \infty]$ is called *admissible* for Γ, abbr. $\rho \in \operatorname{adm}\Gamma$, if $\int\limits_{\gamma} \rho(x)|dx| \geqslant 1$ for each (locally rectifiable) $\gamma \in \Gamma$. The *modulus* of Γ is defined by the relation

$$M(\Gamma) := \inf_{\rho \in \operatorname{adm}\Gamma} \int\limits_{\mathbb{R}^n} \rho^n(x)\, dm(x) \tag{1}$$

interpreted as $+\infty$ if $\operatorname{adm}\Gamma = \varnothing$. Everywhere below, unless otherwise stated, the boundary and the closure of a set are understood in the sense of the extended Euclidean space $\overline{\mathbb{R}^n}$.

Let $Q:\mathbb{R}^n\to[0,\infty]$ be Lebesgue measurable function. We will say that f *satisfies the inverse Poletsky's inequality* if the ratio

$$M(\Gamma)\leqslant\int\limits_{f(D)}Q(y)\cdot\rho_*^n(y)\,dm(y) \qquad (2)$$

holds for any family of (locally rectifiable) paths Γ in D and for any $\rho_*\in\operatorname{adm}f(\Gamma)$. Note that estimates of the type (2) are well known and holds for classes of mappings (see, e.g., [2, Theorem 6.7.II] and [3, theorem 8.5]).

Given sets E and F and a given domain D in $\overline{\mathbb{R}^n}=\mathbb{R}^n\cup\{\infty\}$, we denote by $\Gamma(E,F,D)$ the family of all paths $\gamma:[0,1]\to\overline{\mathbb{R}^n}$ joining E and F in D, that is, $\gamma(0)\in E$, $\gamma(1)\in F$ and $\gamma(t)\in D$ for all $t\in(0,1)$. In accordance with [4], a domain D in $\mathbb{R}^n$ is called *quasiextremal distance domain (QED-domain for short)* if

$$M(\Gamma(E,F,\mathbb{R}^n))\leqslant A_0\cdot M(\Gamma(E,F,D)) \qquad (3)$$

for some finite number $A_0\geqslant 1$ and all continua E and F in D. In the extended Euclidean space $\overline{\mathbb{R}^n}=\mathbb{R}^n\cup\{\infty\}$ we use the *spherical (chordal) metric* $h(x,y)=|\pi(x)-\pi(y)|$, where π is a stereographic projection of $\overline{\mathbb{R}^n}$ onto the sphere $S^n(\frac{1}{2}e_{n+1},\frac{1}{2})=\{x\in\mathbb{R}^{n+1}:|x-e_{n+1}/2|=1/2\}$ in $\mathbb{R}^{n+1}$, and

$$h(x,\infty)=\frac{1}{\sqrt{1+{|x|}^2}}\,,$$

$$h(x,y)=\frac{|x-y|}{\sqrt{1+{|x|}^2}\sqrt{1+{|y|}^2}}\,,\quad x\ne\infty\ne y \qquad (4)$$

(see e.g. [1, Definition 12.1]). In what follows, given $A,B\subset\overline{\mathbb{R}^n}$ we set $h(A,B)=\inf\limits_{x\in A,y\in B}h(x,y)$, where h is a chordal metric in (4). Consider the following definition that has been proposed by Näkki [5], cf. [6]. The boundary of a domain D is called *locally quasiconformal* if every point $x_0\in\partial D$ has a neighborhood U, for which there exists a quasiconformal mapping φ of U onto the unit ball $\mathbb{B}^n\subset\mathbb{R}^n$ such that $\varphi(\partial D\cap U)$ is the intersection of the unit sphere $\mathbb{B}^n$ with a coordinate hyperplane $x_n=0$, where $x=(x_1,\ldots,x_n)$. Note that, with slight differences in the definition, domains with such boundaries are also called collared domains.

Given $\delta>0$, domains $D,D'\subset\mathbb{R}^n$, $n\geqslant 2$, a nondegenerate continuum $A\subset D'$ and a Lebesgue-measurable function $Q:D'\to[0,\infty]$ denote by $\mathfrak{S}_{\delta,A,Q}(D,D')$ the family of all open discrete and closed mappings f of the domain D onto the domain D' satisfying the condition (2) and such that $h(f^{-1}(A),\partial D)\geqslant\ \delta$. The following statement is true.

Theorem 1. *Let $Q\in L^1(D')$, let D be a QED-domain, and D' is a bounded domain with a locally quasiconformal boundary. Then any mapping $f\in\mathfrak{S}_{\delta,A,Q}(D,D')$ which satisfies the relation (2) has a continuous extension $f:\overline{D}\to\overline{D'}$, while, for each point $x_0\in\partial D$ there will be U neighborhoods of this point and constants $C=C(n,A,D,D',x_0)>0$ and $0<\alpha=\alpha(n,A,D,D',x_0)\leqslant 1$ such that*

$$|\overline{f}(x)-\overline{f}(y)|^{\frac{n}{\alpha^2}}\leqslant\frac{C\cdot\|Q\|_1}{\log\left(1+\frac{\delta}{2|x-y|}\right)} \qquad (5)$$

for all $x,y\in U\cap\overline{D}$, where $\|Q\|_1$ is the norm of the function Q in $L^1(D')$.

The result mentioned above is accepted for publication in [7].

References

[1] Väisälä J. *Lectures on n-Dimensional Quasiconformal Mappings.* Lecture Notes in Math. 229. Berlin etc., Springer–Verlag, 1971.
[2] S. Rickman. *Quasiregular mappings.* Springer-Verlag, Berlin, 1993.
[3] Martio O., Ryazanov V., Srebro U. and Yakubov E. *Moduli in Modern Mapping Theory.* Springer Science + Business Media, LLC : New York, 2009.
[4] Gehring F.W., Martio O. Quasiextremal distance domains and extension of quasiconformal mappings. *J. Anal. Math.,* 45: 181–206, 1985.
[5] Näkki R., Prime ends and quasiconformal mappings. *J. Anal. Math.* 35: 13–40, 1979.
[6] Kovtonyuk D. and Ryazanov V. On the theory of prime ends for space mappings. *Ukrainian Math. J.,* 67(4): 528–541, 2015.
[7] Sevost'yanov E., Dovhopiatyi O., Ilkevych N., Androschuk M. On behavior of one class of mappings acting onto domains with a locally quasiconformal boundary. *Ukrainian Math. Zh.* (accepted for print).

Some properties of affine ruled submanifolds

Olena Shugailo
(V. N. Karazin Kharkiv National University, Kharkiv, Ukraine)
E-mail: shugailo@karazin.ua

We consider an affine ruled submanifolds of arbitrary dimension and codimension in the classical sense, that is, a ruled submanifolds over a curve.

Using the equiaffine theory of curves in an arbitrary affine space [1] we choose the most convenient parameterization and transversal distribution of the affine immersion of a ruled submanifold in general case, i. e., of arbitrary dimension and codimension.

All affine characteristics (induced connection, transversal connection, affine fundamental forms, Weingarten operators, curvature tensor) of such an affine immersion are found depending on the characteristics of the base curve and rectilinear generators.

We find the conditions for a base curve and directions of rectilinear generators so that the induced connection is flat. These conditions coincide with the already known properties of affine immersions with flat connection ([2]-[6]). Also we find the conditions for a base curve and directions of rectilinear generators so that the chosen transversal distribution is equiaffine.

Acknowledgment. The author acknowledge the partial support from the Akhiezer Foundation.

References

[1] Davis D. Generic affine differential geometry of curves in R^n. *Proceedings of the Royal Society of Edinburgh Section A: Mathematics*, 136(6) : 1195–1205, 2006
[2] Nomizu K., Pinkall U. On the Geometry of Affine Immersions. *Mathematisce Zeitschrift*, 195 : 165-178, 1987.
[3] Nomizu K., Sasaki T. *Affine differential geometry.* Cambridge University Press, 1994.
[4] Shugailo O.O. On affine immersions with flat connections. *Journal of Math. Physics, Analysis, Geometry*, 8(1) : 90–105, 2012.
[5] Shugailo O. O. Parallel affine immersions $M^n \to \mathbb{R}^{n+2}$ with flat connection. *Ukr. Math. J.*, 65(9) : 1426–1445, 2014.
[6] Shugailo O. O. Equiaffine immersions of codimension two with flat connection and one-dimensional Weingarten mapping. *Matematychni Studii*, 60(1) : 99–-112, 2023.

V. Oles *Computing the Gromov–Hausdorf distance using gradient methods* **91**

G. Ovando *Magnetic trajectories on 2-step nilmanifolds* **92**

I. Ovtsynov *N-foci balls in hyperbolic geometry* **93**

V. Penhryn, O. Nykyforchyn *A retraction from the space of pseudometrics to the space of ultrapseudometrics* **94**

O. Kozachok, A. Petravchuk *Action of derivations on polynomials and on Jacobian derivations* **96**

E. Petrov *Periodic point theorem for mappings contracting total pairwise distance* **98**

I. Pozdniakova, O. Gutik *On the semigroup of non-injective monoid endomorphisms of some extension of the bicyclic monoid* **100**

A. Prishlyak *Structure of gradient bifurcations on compact 2-manifolds* **101**

V. Prokip *About square roots of matrices over factorial domains* **102**

A. Rasila *Results on boundary behavior of quasiregular and harmonic mappings* **104**

F. A. Rossi *Einstein Solvmanifolds not based on Nilsolitons* **104**

J. Saavedra *Ricci flow of G2-type real flag manifolds* **105**

A. Serdyuk, T. Stepaniuk *Approximation by interpolation trigonometric polynomials on the sets of infinitely differentiable functions* **106**

M. Serdiuk *Fundamental solution of non-Archimedean pseudo-differential equation of p-adic argument* **108**

M. Serivka, O. Gutik *On the semigroup of injective monoid endomorphisms of a some extension of the bicyclic semigroup* **109**

R. Servadei *On some nonlocal critical equations* **111**

E. Sevost'yanov, O. Dovhopiatyi, N. Ilkevych, M. Androschuk *On boundary estimates of mappings, acting onto domains with a locally quasiconformal boundary* **111**

O. Shugailo *Some properties of affine ruled submanifolds* **113**

H. Sinyukova *On some vanishing theorems of global character about geodesic mappings of complete Riemannian spaces* **114**

R. Skuratovskii *Subwreath product as structure of normal subgroups of permutational wreath products* **114**

A. Serdyuk, I. Sokolenko *Uniform approximation by Fourier sums in Weyl–Nagy classes $W^r_{\beta,1}$* **117**

I. Petkov, R. Salimov, M. Stefanchuk *On the asymptotic behavior of solutions to nonlinear Beltrami equation* **118**