



International
Scientific Conference



Algebraic and Geometric Methods of Analysis



Devoted to 160 anniversary of
Dvytro Grave
(25.08.1863 - 19.12.1939)
Academician of the Ukrainian
Academy of Sciences, the
first director of the Institute of
Mathematics of NAS of Ukraine

May 29 – June 1, 2023
Odesa, Ukraine

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
- Institute of Mathematics of the National Academy of Sciences of Ukraine
- Taras Shevchenko National University of Kyiv
- Kyiv Mathematical Society

SCIENTIFIC COMMITTEE

- | | |
|--|---|
| • Bolotov D. (<i>Kharkiv, Ukraine</i>) | • Konovenko N. (<i>Odesa, Ukraine</i>) |
| • Bondarenko V. (<i>Kyiv, Ukraine</i>) | • Maksymenko S. (<i>Kyiv, Ukraine</i>) |
| • Boychuk O. (<i>Kyiv, Ukraine</i>) | • Mikhailets V. (<i>Kyiv, Ukraine</i>) |
| • Boyko V. (<i>Kyiv, Ukraine</i>) | • Ostrovskiy V. (<i>Kyiv, Ukraine</i>) |
| • Cherevko Ye. (<i>Odesa, Ukraine</i>) | • Petravchuk A. (<i>Kyiv, Ukraine</i>) |
| • Dorogovtsev A. (<i>Kyiv, Ukraine</i>) | • Plaksa S. (<i>Kyiv, Ukraine</i>) |
| • Drozd Yu. (<i>Kyiv, Ukraine</i>) | • Portenko M. (<i>Kyiv, Ukraine</i>) |
| • Gerasymenko V. (<i>Kyiv, Ukraine</i>) | • Pratsiovytyi M. (<i>Kyiv, Ukraine</i>) |
| • Fedchenko Yu. (<i>Odesa, Ukraine</i>) | • Savchenko O. (<i>Kherson, Ukraine</i>) |
| • Kiosak V. (<i>Odesa, Ukraine</i>) | • Romanyuk A. (<i>Kyiv, Ukraine</i>) |
| • Kochubei A. (<i>Kyiv, Ukraine</i>) | • Timokha O. (<i>Kyiv, Ukraine</i>) |

ORGANIZING COMMITTEE

- | | |
|--|---|
| • Maksymenko S. (<i>Kyiv, Ukraine</i>) | • Cherevko Ye. (<i>Odesa, Ukraine</i>) |
| • Konovenko N. (<i>Odesa, Ukraine</i>) | • Osadchuk Ye. (<i>Odesa, Ukraine</i>) |
| • Fedchenko Yu. (<i>Odesa, Ukraine</i>) | • Sergeeva O. (<i>Odesa, Ukraine</i>) |

- [18] O.O. Vaneeva, R.O. Popovych, C. Sophocleous. Extended symmetry analysis of two-dimensional degenerate Burgers equation. *J. Geom. Phys.*, 169 : Paper No. 104336, 21 pp., 2021.
- [19] V.M. Boyko, O.V. Lokaziuk, R.O. Popovych. Realizations of Lie algebras on the line and the new group classification of $(1+1)$ -dimensional generalized nonlinear Klein-Gordon equations. *Anal. Math. Phys.*, 11(3) : Paper No. 127, 38 pp., 2021.
- [20] A.G. Nikitin. Symmetries of Schrödinger-Pauli equations for charged particles and quasirelativistic Schrödinger equations. *J. Phys. A*, 55(11) : Paper No. 115202, 24 pp., 2022.
- [21] V.V. Lychagin, V.N. Rubtsov, I.V. Chekalov. A classification of Monge-Ampère equations. *Ann. Sci. École Norm. Sup. (4)*, 26(3) : 281–308, 1993.
- [22] D. Tseluiko. On classification of hyperbolic Monge-Ampère equations on 2-dimensional manifolds. *Rend. Sem. Mat. Messina Ser. II*, 8(23) : 139–150, 2004.
- [23] A. De Paris, A.M. Vinogradov. Scalar differential invariants of symplectic Monge-Ampère equations. *Cent. Eur. J. Math.*, 9(4) : 731–751, 2011.
- [24] V.I. Fushchich, N.I. Serov. Symmetry and some exact solutions of the multidimensional Monge-Ampère equation. *Dokl. Akad. Nauk SSSR*, 273(3) : 543–546, 1983.
- [25] V.I. Fushchich, V.M. Shtelen, N.I. Serov. *Symmetry analysis and exact solutions of nonlinear equations of mathematical physics*. Kiev : Naukova Dumka, 1989.
- [26] C. Udriște, N. Bîlă. Symmetry Lie group of the Monge-Ampère equation. *Balkan J. Geom. Appl.*, 3(2) : 121–134, 1998.
- [27] C. Udriște, N. Bîlă. Symmetry Lie group of the Monge-Ampère equation. *Appl. Sci.*, 1(1) : 60–74, 1999.
- [28] C. Udriște, N. Bîlă. Symmetry group of Țițeica surfaces PDE. *Balkan J. Geom. Appl.*, 4 : 123–140, 1999.
- [29] V.M. Fedorchuk, V.I. Fedorchuk. On classification of the low-dimensional nonconjugate subalgebras of the Lie algebra of the Poincaré group $P(1,4)$. *Proc. of the Inst. of Math. of NAS of Ukraine. Kyiv : Institut of Mathematics of NAS of Ukraine*, 3(2) : 302–308, 2006.
- [30] V.M. Fedorchuk, V.I. Fedorchuk. First-order differential invariants of the splitting subgroups of the Poincaré group $P(1,4)$. *Univ. Iagel. Acta Math.*, 44 : 21–30, 2006.
- [31] V.M. Fedorchuk, V.I. Fedorchuk. On non-equivalent functional bases of first-order differential invariants of the nonconjugate subgroups of the Poincaré group $P(1,4)$. *Acta Physica Debrecina.*, 42 : 122–132, 2008.

Homotopy type of stabilizers of functions with non-isolated singularities on surfaces

Bohdan Feshchenko

(Institute of Mathematics of NAS of Ukraine, Kyiv, Ukraine)

E-mail: fb@imath.kiev.ua

Let M be a smooth compact surface, $\mathcal{D}(M)$ be a group of diffeomorphisms of M , and P be either \mathbb{R} or S^1 . For a smooth function $f : M \rightarrow P$ denote by $\mathcal{S}(f)$ a group of f -preserving diffeomorphisms of M , i.e.,

$$\mathcal{S}(f) = \{h \in \mathcal{D}(M) \mid f \circ h = f\},$$

and by $\mathcal{S}_{\text{id}}(f)$ a connected component of $\mathcal{S}(f)$ containing id_M .

In [1] the author considered the following class of functions $\mathcal{F}(M, P)$ and described the homotopy type of $\mathcal{S}_{\text{id}}(f)$ for functions from it.

Definition 1. A smooth function $f \in C^\infty(M, P)$ on M belongs to the class $\mathcal{F}(M, P)$ if the following conditions are satisfied:

- (1) for each connected component V of the boundary ∂M a function $f|_V$ either takes a constant value or is a covering map,

- (2) a set of critical points Σ_f of f is a disjoint union of smooth submanifolds of M and $\Sigma_f \subset \text{Int}(M)$,
- (3) for each connected component C of Σ_f and each critical point $p \in C$ there exist a local chart $(U, \phi : U \rightarrow \mathbb{R}^2)$ near p and a chart $(V, \psi : V \rightarrow \mathbb{R})$ near $f(p) \in P$ such that $f(U) \subset V$ and a local representation $\psi \circ f \circ \phi^{-1} : \phi(U) \rightarrow \psi(V)$ of f is
- (a) either a homogeneous polynomial $f_p : \mathbb{R}^2 \rightarrow \mathbb{R}$ of degree $\deg f_p \geq 2$ having no multiple factors,
 - (b) or is given by $f_C(x, y) = \pm y^{n_C}$ for some $n_C \in \mathbb{N}_{\geq 2}$ depending of C .

Note that the class $\mathcal{F}(M, P)$ contains the class of P -valued Morse-Bott functions on M .

Theorem 2 (Theorem 1.2 [1]). *For a function $f \in \mathcal{F}(M, P)$ the group $\mathcal{S}_{\text{id}}(f)$ is contractible if f has at least one saddle or M is non-oriented, otherwise $\mathcal{S}_{\text{id}}(f)$ is homotopy equivalent to S^1 .*

REFERENCES

- [1] Bohdan Feshchenko. *Homotopy type of stabilizers of circle-valued functions with non-isolated singularities on surfaces*, arXiv:2305.08255, 2023

On direct limits of Minkowski's balls, domains, and their critical lattices

Nikolaj Glazunov

(Glushkov Institute of Cybernetics NASU, Kiev,
Institute of Mathematics and Informatics Bulgarian Academy of Sciences, 1113 Sofia,
Bulgaria.)

E-mail: glanm@yahoo.com

We construct direct systems of Minkowski, Davis and Chebyshev-Cohn balls and domains, direct systems of their critical lattices and calculate their direct limits. By (general) Minkowski balls we mean (two-dimensional) balls in \mathbb{R}^2 of the form

$$D_p : |x|^p + |y|^p \leq 1, \quad p \geq 1. \quad (1)$$

From the proof of Minkowski's conjecture [1, 2, 3, 4, 5, 8] in notations [8, 9] we have next expressions for critical determinants and their lattices:

Theorem 1. (1) $\Delta(D_p) = \Delta_p^{(0)} = \Delta(p, \sigma_p) = \frac{1}{2}\sigma_p$, $2 \leq p \leq p_0$;

(2) $\sigma_p = (2^p - 1)^{1/p}$,

(3) $\Delta(D_p) = \Delta_p^{(1)} = \Delta(p, 1) = 4^{-\frac{1}{p} \frac{1+\tau_p}{1-\tau_p}}$, $1 \leq p \leq 2$, $p \geq p_0$,

(4) $2(1 - \tau_p)^p = 1 + \tau_p^p$, $0 \leq \tau_p < 1$,

where p_0 is a real number that is defined unique by conditions $\Delta(p_0, \sigma_p) = \Delta(p_0, 1)$, $2, 57 < p_0 < 2, 58$, $p_0 \approx 2.5725$

For their critical lattices respectively $\Lambda_p^{(0)}$, $\Lambda_p^{(1)}$ next conditions satisfy: $\Lambda_p^{(0)}$ and $\Lambda_p^{(1)}$ are two D_p -admissible lattices each of which contains three pairs of points on the boundary of D_p with the property that $(1, 0) \in \Lambda_p^{(0)}$, $(-2^{-1/p}, 2^{-1/p}) \in \Lambda_p^{(1)}$,

Denote by $V(D_p)$ the volume (area) of D_p .

V. Dryuma <i>On geodesic lines of Riemannian metric for Navier-Stokes equations</i>	29
L. Fardigola, K. Khalina <i>On controllability problems for the heat equation in a half-plane in the case of a pointwise control in the Dirichlet boundary condition</i>	32
V. Fedorchuk, V. Fedorchuk <i>On partial preliminary group classification of some class of $(1 + 3)$-dimensional Monge-Ampere equations. Two-dimensional Abelian Lie algebras</i>	34
B. Feshchenko <i>Homotopy type of stabilizers of functions with non-isolated singularities on surfaces</i>	36
N. Glazunov <i>On direct limits of Minkowski's balls, domains, and their critical lattices</i>	37
O. Gok <i>On KB(Kantorovich-Banach) spaces and KB operators</i>	39
M. Golański <i>On polynomial and regular maps of spheres</i>	40
O. Gutik, O. Prokhorenkova <i>On homomorphisms of bicyclic extensions of archimedean totally ordered groups</i>	41
O. Hukalov, V. Gordevskyy <i>The Interaction of an Infinite Number of Eddy Flows</i>	42
S. Ivković <i>Semi-Fredholm theory in unital C^*-algebras</i>	43
T. Jaiyeola, K. Ilori, O. Oyebola <i>On some non-associative hyper-algebraic structures</i>	45
J.-L. Mo <i>The rank of Mordell-Weil groups of surfaces</i>	47
J. Kąkol <i>On Asplund spaces $C_k(X)$ with the compact-open topology</i>	48
N. Kitazawa <i>Explicit construction of explicit real algebraic functions and real algebraic manifolds via Reeb graphs</i>	49
N. Kononenko <i>Conformal equivalence of 3-webs</i>	51
Y. Kopeliovich <i>The fundamental group of Riemann surface via Riemann's existence theorem</i>	52
G. Kuduk <i>Problem with integral conditions for evolution equations in Banach space</i>	53
I. Kuznietsova, S. Maksymenko <i>Deformational symmetries of functions with isolated singularities on the Mobius band</i>	54
R. L'hamri <i>Codes from zero-divisor super-λ graph</i>	55
L. Lotarets <i>Twisted Sasaki metric on the unit tangent bundle and harmonicity</i>	56