International scientific online conference

«Algebraic and geometric methods of analysis»

May 25-28, 2026.

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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Normal forms of Morse-Bott functions without saddles on compact oriented surfaces

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Let M be a smooth compact and oriented surface, and denote by P a real line $\mathbb{R}$ or a circle S^1. Denote by $\mathcal{F}^0(M,P)$ a class of Morse-Bott functions without saddles on M with the value in P. This class of functions naturally arises in the study of homotopy type of stabilizers of Morse-Bott functions on surfaces with respect to the action of the group of diffeomorphisms by pre-composition, see details in [1]. It is known that this class is non-empty if M is diffeomorphic to one of the following list: a cylinder $S^1 \times [0,1]$, a disk D^2, a sphere S^2, a torus T^2.

There are some trivial examples of functions from $\mathcal{F}^0(M,P)$ that are easy to write by hand:

Example 1. Let $f_0 : M_0 \to P$ be a smooth function from $\mathcal{F}^0$

(1_0) $M_0 = S^1 \times [0,1] = \{(z,s) \,|\, z \in \mathbb{C}, |z| = 1,\ 0 \le s \le 1\}$ is a unit cylinder, and $f_0 : S^1 \times [0,1] \to \mathbb{R}$ is given by $f_0(z,s) = s$,

(2_0) $M_0 = D^2 = \{(x,y) \in \mathbb{R}^2 \,|\, x^2 + y^2 \le 1\}$ is a unit 2-disk, and $f_0 : D^2 \to \mathbb{R}$ is given by $f_0(x,y) = x^2 + y^2$,

(3_0) $M_0 = S^2 = \{(x,y,z) \in \mathbb{R}^3 \,|\, x^2 + y^2 + z^2 = 1\}$ is a unit sphere, and $f_0 : S^2 \to \mathbb{R}$ is given by $f_0(x,y,z) = z$,

(4_0) $M_0 = T^2 = \{(w,z) \in \mathbb{C}^2 \,|\, |z| = |w| = 1\}$ is a unit 2-torus, and $f_0 : T^2 \to S^1$ is given by $f_0(w,z) = z$.

Note that these functions do not have critical circles. We will call them **prime functions**.

Our main result is the following theorem, see [2].

Theorem 2. *A function $f \in \mathcal{F}^0(M,P)$ admits the following decomposition*

$$f = \varkappa \circ f_0 \circ h^{-1} \tag{1}$$

where $h : M_0 \to M$ is a diffeomorphism, $f_0 \in \mathcal{F}^0(M_0,P)$ is a prime function, and a smooth function $\varkappa : f_0(M_0) \to P$ which satisfies the following conditions:

(A) *$\varkappa$ has the only finite number of non-degenerated critical points,*

(B) *$\varkappa$ does not have critical points at $f_0(\Sigma_{f_0})$ and $f_0(\partial M)$,*

where Σ_{f_0} is the set of critical points of f_0. A factorization (1) is not unique and depends on the choice of h. In particular, if f has no critical circles, then $\varkappa$ is a diffeomorphism.

References

[1] Bohdan Feshchenko. Homotopy type of stabilizers of circle-valued functions with non-isolated singularities on surfaces. *arXiv:2305.08255*, 9p., 2023

[2] Bohdan Feshchenko. Normal forms of functions with degenerate singularities on surfaces equipped with semi-free circle actions. *arXiv:2412.18944*, 18p., 2024.

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