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

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Theorem. Let in the problem (1), (2), the vectors φ_k belongs L. There $\varphi_k, k = \{1, 2\}$ can be represented in the form (5). Then the formula

$$U(t) = \int_{\Lambda} R_{\varphi_1}(\lambda)\{M_0(t,\lambda)x(\lambda)d\mu_{\varphi_1}(\lambda) + \int_{\Lambda} R_{\varphi_2}(\lambda)\{M_1(t,\lambda)x(\lambda)d\mu_{\varphi_2}(\lambda),$$

defines solution of the problem (1), (2), $M_m(t, \lambda)$ is a solution of the problem (3), (4).

Be means of the differential-symbol method [5] we construct of the problem (1), (2).

Solution of the problem (3), (4) according to the differential-symbol [1, 2] method exists and uniquess in the class of quasi-polynomials.

References

[1] P. I. Kalenyuk, Z. N. Nytrebych Generalized scheme of separation of variables. Differential-symbol method. – Lviv: Publishing house of Lviv Polytechnic National University, 2002. – 292 p. *in Ukrainian*

[2] P. I. Kalenyuk, G. Kuduk, I.V. Kohut, Z.N. Nytrebych. Problem with integral condition fordifferential-operator equation // Math. Methods and Phys. - mech. Polia. Vol. 56 : 7-15. 2013.

Deformational symmetries of functions with isolated singularities on the Mobius band

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Let M be a smooth compact 2-dimensional manifold which have a non-empty boundary, and P be either a real line or a circle. Denote by $D(M, Y)$ the group of diffeomorphisms of M fixed on a closed subset $Y \subset M$. There is a natural right action of the group $D(M, Y)$ on the space of smooth functions $C^\infty(M, \mathbb{R})$ defined by the following rule: $(h, f) \longmapsto f \circ h$, where $h \in D(M, Y)$, $f \in C^\infty(M, \mathbb{R})$.

Let

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

be the *orbit* of f under this action. Endow $C^\infty(M, \mathbb{R})$ with Whitney C^∞-topology and $\mathcal{O}(f, Y)$ with induced one.

Definition 1. Denote by $\mathcal{F}(M, P)$ the space of smooth maps $f \in C^\infty(M, P)$ having the following properties:

(1) the map f takes constant values at each connected component of ∂M and has no critical points on it;
(2) for every critical point z of f there is a local presentation $f_z \colon \mathbb{R}^2 \to \mathbb{R}$ of f near z such that f_z is a homogeneous polynomial $\mathbb{R}^2 \to \mathbb{R}$ without multiple factors.

Definition 2. Let G, H be groups, $m \in \mathbb{Z}$ and $\gamma\colon H \to H$ be automorphism of order 2. Define the automorphism $\phi\colon G^{2m} \times H^m \to G^{2m} \times H^m$ by the formula

$$\phi(g_0, \dots, g_{2m-1}, h_0, \dots, h_{m-1}) = (g_{2m-1}, g_0, \dots, g_{2m-2}, h_1, h_2, \dots, h_{m-1}, \gamma(h_0)).$$

This automorphism ϕ generates homomorphism $\phi'\colon \mathbb{Z} \to G^{2m} \times H^m$. The corresponding semidirect product $G^{2m} \times H^m \rtimes_{\phi'} \mathbb{Z}$ will be denoted $(G, H) \wr_{\gamma,m} \mathbb{Z}$.

Definition 3. Let $\mathcal{P}$ be a minimal class of groups satisfying the following conditions:

1) $1 \in \mathcal{P}$;
2) if $A, B \in \mathcal{P}$, then $A \times B \in \mathcal{P}$;
3) if $A \in \mathcal{P}$ and $n \geq 1$, then $A \wr_n \mathbb{Z} \in \mathcal{P}$.

It was shown in [2] that if M has negative Euler characterictic, then fundamental groups of orbits of functions in $\mathcal{F}(M, P)$ are direct products of such groups for functions only on cylinders, disks and Möbius bands. Moreover, if M is either a 2-disk or a cylinder, then $\pi_1\mathcal{O}(f, \partial M) \in \mathcal{P}$.

Theorem 4. *Let M be a Möbius band and let $f \in \mathcal{F}(M, P)$. Then*

$$\pi_1\mathcal{O}(f, \partial M) \cong A \times (G, H) \wr_{\gamma,m} \mathbb{Z}, \text{ where } A, G, H \in \mathcal{P}.$$

References

[1] Iryna Kuznietsova, Sergiy Maksymenko. Homotopy properties of smooth functions on the Möbius band, *Proceedings of the International Geometry Center*, vol. 12, no. 3, 2019.

[2] Maksymenko S. I. Deformations of functions on surfaces by isotopic to the identity diffeomorphisms. *Topology and its Applications*, vol. 282, 2020.

Codes from zero-divisor super-λ graph

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In coding theory, super-λ graphs were used to build linear codes. Thus, in order to see whether the zero-divisor graphs might be useful into this context, it is natural to study when zero-divisor graphs of some non elementary ring constructions are super-λ graphs. In this presentation, we show that there are various classes of rings whose zero-divisor graphs are super-λ. We apply these results to determine parameters of some linear codes associated to zero-divisor graphs.

References

[1] D. Bennis, R. L'hamri, and K. Ouarghi. Zero-divisor super-λ graphs. Sao Paulo J. Math. Sci. **16** (2022), 1–17.