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.** (*Kharkiv, Ukraine*)
- **Bondarenko V.** (*Kyiv, Ukraine*)
- **Boychuk O.** (*Kyiv, Ukraine*)
- **Boyko V.** (*Kyiv, Ukraine*)
- **Cherevko Ye.** (*Odesa, Ukraine*)
- **Dorogovtsev A.** (*Kyiv, Ukraine*)
- **Drozd Yu.** (*Kyiv, Ukraine*)
- **Gerasymenko V.** (*Kyiv, Ukraine*)
- **Fedchenko Yu.** (*Odesa, Ukraine*)
- **Kiosak V.** (*Odesa, Ukraine*)
- **Kochubei A.** (*Kyiv, Ukraine*)
- **Konovenko N.** (*Odesa, Ukraine*)
- **Maksymenko S.** (*Kyiv, Ukraine*)
- **Mikhailets V.** (*Kyiv, Ukraine*)
- **Ostrovskyi V.** (*Kyiv, Ukraine*)
- **Petravchuk A.** (*Kyiv, Ukraine*)
- **Plaksa S.** (*Kyiv, Ukraine*)
- **Portenko M.** (*Kyiv, Ukraine*)
- **Pratsiovytyi M.** (*Kyiv, Ukraine*)
- **Savchenko O.** (*Kherson, Ukraine*)
- **Romanyuk A.** (*Kyiv, Ukraine*)
- **Timokha O.** (*Kyiv, Ukraine*)

Organizing commitee

- **Maksymenko S.** (*Kyiv, Ukraine*)
- **Konovenko N.** (*Odesa, Ukraine*)
- **Fedchenko Yu.** (*Odesa, Ukraine*)
- **Cherevko Ye.** (*Odesa, Ukraine*)
- **Osadchuk Ye.** (*Odesa, Ukraine*)
- **Sergeeva O.** (*Odesa, Ukraine*)

$[a_i, b_i]$ *is the commutator of* 2 *group elements given by:* $[x, y] = xy(yx)^{-1}$

However when you first encounter Algebraic curves (Riemann Surfaces) they are presented through cuts and analytic continuation in a pictersque way. I have never seen a proof in the literature that the fundamental group of the surface given pictorially by cuts has a representation given by the theorem. Indeed the starting point of surface groups is the commutation relation. In this talk I will try to fill this gap. While I don't have a formal proof yet I will present some results that to me seems somewhat surprising. The talk is elementary in nature and no knowledge of heavy topology is required.

REFERENCES

[1] Mike Fried. Combinatorial Computation of Moduli Dimension of Nielsen Classes of Covers Emphasis on the solvable cover case with historical comments from Zariski 1989 Contemporary Mathematics .

Problem with integral conditions for evolution equations in Banach space

Grzegorz Kuduk
(Faculty of Mathematics and Natural Sciences University of Rzeszow,Graduate of University)
E-mail: `gkuduk@onet.eu`

Let A be a given linear operator acting in the Banach space B, and for this operator, arbitrary powers $A^n : B \to B$, $n \in \mathbb{N}$. Denote be $x(\lambda)$ the eigenvector of the operator A which corresponds to its eigenvalue $\lambda \in \Lambda$, i.s. nonzero solution in B of the equation $Ax(\lambda) = \lambda x(\lambda), \lambda \in \Lambda$, where $\lambda \subset \mathbb{C}$. If Λ is not an eigenvalue of the operator A then $x(\lambda) = 0$.

We consider next problem with integrals condition

$$\frac{d^2U}{dt^2} + a(A)\frac{dU}{dt} + b(A)U = 0, \quad t \in [0, T], \tag{1}$$

$$\int_0^T U(t)dt = \varphi_1, \quad \int_0^T tU(t)dt = \varphi_2, \tag{2}$$

where $\varphi_1, \varphi_2 \in B$, $T > 0$, $u : (0; \alpha) \cup (\beta; h) \to B$ - is an unknown function, $a(A) : B \to B$, $b(A) : B \to B$ - is abstract operators with entire symbols $a(\lambda) \neq const$, $b(\lambda) \neq const$.

Let for $m = \{0, 1\}$ function $M_m(t, \lambda)$ be a solution of the problem

$$\frac{d^2M_m(t, \lambda)}{dt^2} + a(\lambda)\frac{dM_m(t, \lambda)}{dt} + b(\lambda)M_m(t, \lambda) = 0, \quad t \in [0, T], \tag{3}$$

$$\int_0^T t^k M_m(t, \lambda)dt = \delta_{km}, \quad k = \{0, 1\}, \tag{4}$$

where δ_{km} is the Kronecker symbol.

Definition. We shall say that vectors $\varphi_1, \varphi_2 \in B$, from B belong $L \subset B$. If dependent exists on linear operators $R_{\varphi_k}(\lambda) : B \to B$, $\lambda \in \Lambda$ and measures μ_{φ_k} such that

$$\varphi_k = \int_\Lambda R_{\varphi_k}(\lambda)x(\lambda)d\mu_{\varphi_k(\lambda)}. \tag{5}$$

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

Iryna Kuznietsova
(Institute of Mathematics of NAS of Ukraine, Kyiv, Ukraine)
E-mail: `kuznietsova@imath.kiev.ua`

Sergiy Maksymenko
(Institute of Mathematics of NAS of Ukraine, Kyiv, Ukraine)
E-mail: `maks@imath.kiev.ua`

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.

V. Dryuma *On geodesic lines of Riemannian metric for Navier-Stokes equations* **29**

L. Fardigola, K. Khalina *On controllability problems for the heat equation in a half-plane in the case of a pointwise control in the Dirichlet boundary condition* **32**

V. Fedorchuk, V. Fedorchuk *On partial preliminary group classification of some class of* $(1+3)$*-dimensional Monge-Ampere equations. Two-dimensional Abelian Lie algebras* **34**

B. Feshchenko *Homotopy type of stabilizers of functions with non-isolated singularities on surfaces* **36**

N. Glazunov *On direct limits of Minkowski's balls, domains, and their critical lattices* **37**

O. Gok *On KB(Kantorovich-Banach) spaces and KB operators* **39**

M. Golasiśki *On polynomial and regular maps of spheres* **40**

O. Gutik, O. Prokhorenkova *On homomorphisms of bicyclic extensions of archimedean totally ordered groups* **41**

O. Hukalov, V. Gordevskyy *The Interaction of an Infinite Number of Eddy Flows* **42**

S. Ivković *Semi-Fredholm theory in unital* C^**-algebras* **43**

T. Jaiyeola, K. Ilori, O. Oyebola *On some non-associative hyper-algebraic structures* **45**

J.-L. Mo *The rank of Mordell-Weil groups of surfaces* **47**

J. Kąkol *On Asplund spaces* $C_k(X)$ *with the compact-open topology* **48**

N. Kitazawa *Explicit construction of explicit real algebraic functions and real algebraic manifolds via Reeb graphs* **49**

N. Konovenko *Conformal equivalence of 3-webs* **51**

Y. Kopeliovich *The fundamental group of Riemann surface via Riemann's existence theorem* **52**

G. Kuduk *Problem with integral conditions for evolution equations in Banach space* **53**

I. Kuznietsova, S. Maksymenko *Deformational symmetries of functions with isolated singularities on the Mobius band* **54**

R. L'hamri *Codes from zero-divisor super-*λ *graph* **55**

L. Lotarets *Twisted Sasaki metric on the unit tangent bundle and harmonicity* **56**