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

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[12] Jardim M and Earp HNSá. Monad construction of asymptotically stable Bundles. arXiv (September,2011). arxiv.org/pdf/1109.2750v1.pdf
[13] Jardim M, Menet M, Prata D and Earp HNSá. Holomorphic bundles for higher dimensional gauge theory. Bulletin London Mathematical society, 49 (2017). doi: 10.1112/blms.12017.
[14] Kumar, N. Construction of rank two vector bundles on $\mathbf{P}^4$ in positive characteristic. Invent math 130, 277–286 (1997). doi 10.1007/s002220050185
[15] Kumar N, Peterson C and Rao A P. Construction of low rank vector bundles on $\mathbf{P}^4$ and $\mathbf{P}^5$, Journal of Algebraic Geometry 11 (2) (2002), 203–217. doi 10.1090/S1056-3911-01-00309-5
[16] Maingi D. Vector Bundles of low rank on a multiprojective space. Le Matematiche. Vol. LXIX (2014) - Fasc. II. pp 31-41. doi: 10.4418/2014.69.2.4.
[17] Maingi D (2021). Indecomposable Vector Bundles associated to Monads on Cartesian products of projective spaces. Turkish Journal of Mathematics. Vol. 45: No. 5. Article 17. Pages 2126-2139. doi: 10.3906/mat-2101-6
[18] Maingi D. Monads on multiprojective Products of Projective Spaces. to appear in Manuscripta Mathematica (2023),doi: 10.1007/s00229-022-01449-0.
[19] Marchesi S, Marques P M and Soares H. Monads on a Projective Varieties. Pacific Journal of Mathematics, vol 296 (2018), no. 1, 155-180. doi: 10.2140/pjm.2018.296.155.
[20] Okonek C, Schneider M and Spindler H. Vector Bundles on Complex Projective Spaces. Springer, 1980, doi.org/10.1007/978-1-4757-1460-9
[21] Perrin D. Géométrie algébrique. Une introduction, (1995), EDP Sciences/CNRS édition. ISBN-2-7296-0563-0
[22] Spindler H and Trautmann G. Special Instanton bundles on $\mathbf{P}^{2n+1}$ their geometry and their moduli. Mathematische Annalen 286. 1-3 (1990): 559-592. doi: 10.1215/S0012-7094-93-07125-6
[23] Tango, H. An example of indecomposable vector bundle of rank $n-1$ on $\mathbf{P}^n$, $n \geq 3$. Journal of Mathematics of Kyoto University, 16, (1976): 137-141, doi: 10.1215/kjm/1250522965.
[24] Tango H. On morphisms from projective space $\mathbf{P}^n$ to the Grassmann variety $\mathbb{G}r(n,d)$, Journal of Mathematics of Kyoto University, 16 (1976), 201-207. doi: 10.1215/kjm/1250522969.

About one problem of the Gauss-Kuzmin type

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Let $[a_0; a_1, ..., a_n, ...]$ — continued fraction, where $a_0 \in Z_+$, $a_j > 0$ for all $j \in N$. Consider left shift operator

$$T([0; a_1, a_2, ..., a_n, ...]) = [0; a_2, a_3, ..., a_{n+1}, ...].$$

Let $f_n(x) = \lambda(T^{-n}((0; x]))$, where $x \in (0; 1]$, $\lambda(\cdot)$ — Lebesgue measure. The problem of finding

$$f(x) = \lim_{n \to +\infty} f_n(x)$$

for classical continued fractions was posed by Gauss. Kuzmin [1] showed that $f(x) = \log_2(x+1)$ and

$$|f_n(x) - \log_2(1+x)| \leq C\beta^{(n^\eta)} \quad \forall x \in (0; 1]$$

for $\eta = 0,5$ some $C > 0$ and $\beta \in (0; 1)$. Levy [2] showed that it is possible to take $\beta = 0,7$ and $\eta = 1$. Wirsing [4] showed that, for the constant $\gamma \approx 0,3037$

$$\psi(x) = \lim_{n \to +\infty} \frac{f_n(x) - \log_2(1+x)}{(-\gamma)^n} \quad \forall x \in (0; 1],$$

where $\psi(x)$ — analytic function.

It is known [3] that for each $t \in [0,5; 1]$ there exists a sequence (b_n) such that $b_n \in \{0,5; 1\}$ for all $n \in N$ and $t = [0; b_1, ..., b_n, ...]$. The last image is called A_2-image. A countable set of numbers $t \in [0,5; 1]$ has two A_2-images.

Theorem 1. *For A_2-image the following conditions are true for some numbers $C_1 > C_2 > 0$ and for each $n \in N$*

$$|f_{n+1}(x_1) - f_{n+1}(x_2)| = |f_n((1+x_1)^{-1}) - f_n((1+x_2)^{-1})| + |f_n((0,5+x_1)^{-1}) - f_n((0,5+x_2)^{-1})| \forall x_1, x_2 \in [0,5;1];$$

$$C_2|x_2 - x_1| \leq |f_n(x_1) - f_n(x_2)| \leq C_1|x_2 - x_1| \ \ \forall x_1, x_2 \in [0,5;1], x_1 \leq x_2.$$

References

[1] Kuzmin Rodion. On a problem of Gauss. *Dokl. Akad. Nauk SSSR Ser. A* 375-380, 1928.

[2] Levy Paul. Sur les lois de probabilite dont dependent les quotients complets et incomplets dune fraction continue. *Bull. Soc. Math. France* 57: 178-194, 1929.

[3] Pratsiovytyi Mykola., Chuikov Artem. Continuous distributions whose functions preserve tails of a A-continued fraction representation of numbers. *Random Operators and Stochastic Equations*,27(3): 199–206, 2019.

[4] Wirsing Eduard. On the theorem of Gauss-Kuzmin-Levy and a Frobeniustype theorem for function spaces. *Acta Arithmetica* 24: 506-528, 1974.

Homotopy types of stabilizers of Morse-Bott functions on 3-manifolds

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Let M be a smooth 3-manifold, $\mathcal{D}(M)$ be the group of all C^∞ diffeomorphisms of M. For every smooth function $f : M \to \mathbb{R}$ denote by

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

the stabilizer of f with respect to the natural action of $\mathcal{D}(M)$ on the space of all C^∞ functions on M. It consists of diffeomorphisms leaving invariant each level set of f. Endow $\mathcal{S}(f)$ with the corresponding strong C^∞ Whitney topology.

Let B be a submanifold of M. Then a *regular neighborhood* of B is a vector bundle $p\colon E \to B$ defined on an open neighborhood E of B in M and being a smooth retraction onto B. In that case a function $g\colon E \to \mathbb{R}$ is called 2-*homogeneous* if $g(tx) = t^2 g(x)$ for all $x \in E$ and $t \geq 0$.

Definition 1. Say that a Morse-Bott function $f : M \to \mathbb{R}$ is 2-*homogeneous* if for every critical submanifold B of f of dimension 1 and 2 there exists a tubular neighborhood $p\colon E \to B$ and a 2-homogeneous on fibers function $g\colon E \to \mathbb{R}$ such that $f = g$ near B.

Notice that in general (due to Morse-Bott lemma) f is 2-homogeneous only locally at each critical point x of f.

Now let $f\colon M \to \mathbb{R}$ be a C^∞ Morse-Bott function taking constant values at boundary components of M. Let also Γ be the Kronrod-Reeb graph of f, being the quotient of M by the partition into connected component of every level set of f, and $p : M \to \Gamma$ be the natural projection.

Say that an edge e of Γ is *internal* if its vertices have degrees ≥ 2, i.e. they correspond to non-extremal critical submanifodls of f. At each edge e of Γ fix a point x_e and put $N_e = p^{-1}(x_e)$. Thus, N_e is a closed subsurface of M on which f takes a constant value.

Theorem 2. *Let $f\colon M \to \mathbb{R}$ be a 2-homogeneous Morse-Bott function. Let also n be the total number of those N_e for which*

- *the edge e is internal and*
- *N_e is a 2-sphere or a projective plane.*