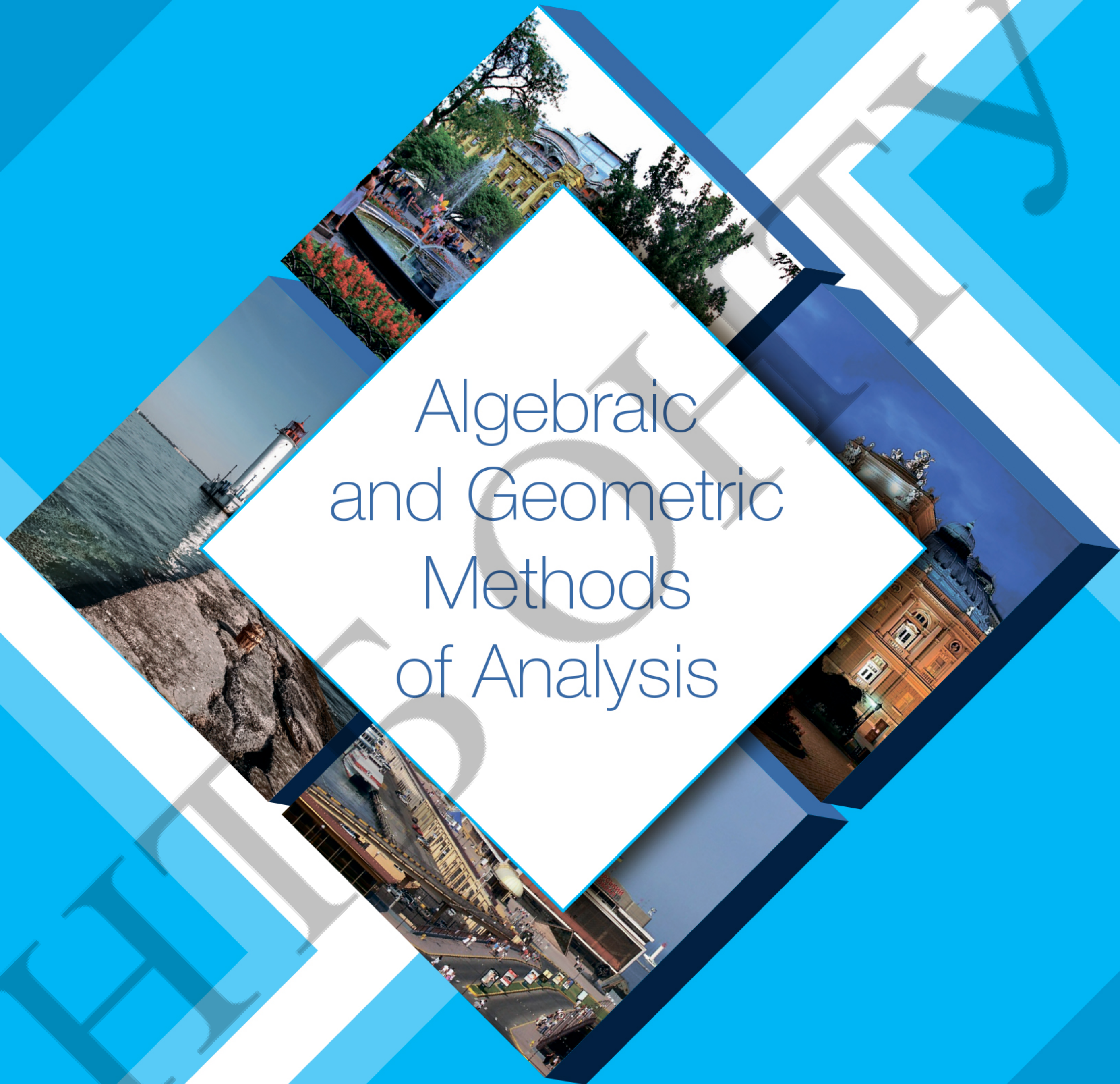
International
Scientific Conference



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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[3] Vaneeva O.O., Bihlo A. and Popovych R.O., Generalization of the algebraic method of group classification with application to nonlinear wave and elliptic equations, *Commun. Nonlinear Sci. Numer. Simul.* **91** (2020), 105419, arXiv:2002.08939.

Integral problem for system of partial differential equations of third order

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Let $H(\mathbb{R}_+ \times \mathbb{R}^n)$ be a class of entire functions on $\mathbb{R}$, K_L is a class of quasipolynomials of the form $\varphi(x) = \sum_{i=1}^{n} Q_r(x) \exp[\alpha_r x]$, where $\alpha_r \in L \subseteq \mathbb{C}$, $\alpha_k \neq \alpha_l$, for $k \neq l$, $Q_r(x)$ are given polynomials.

Each quasipolynomial defines a differential operator $\varphi\left(\frac{\partial}{\partial\lambda}\right)$ of finite order on the class of entire function, in the form $\sum_{r=1}^{m} Q_r\left(\frac{\partial}{\partial\lambda}\right) \exp\left[\alpha_i \frac{\partial}{\partial\lambda}\right]\Big|_{\lambda=0}$.

In the strip $\Omega = \{(t,x) \in \mathbb{R}^{n+1} : t \in \{([T_1,T_2] \cup [T_3,T_4]), x \in \mathbb{R}^n\}$, we consider of the system of equations

$$\frac{\partial^3 U_i}{\partial t^3} + \sum_{j=1}^{n} \left\{ a_{ij}\left(\frac{\partial}{\partial x}\right) \frac{\partial^2 U_j}{\partial t^2} + b_{ij}\left(\frac{\partial}{\partial x}\right) \frac{\partial U_j}{\partial t} + c_{ij}\left(\frac{\partial}{\partial x}\right) \right\} U_j(t,x) = 0, \tag{1}$$

$$\int_{T_1}^{T_2} U_{ik}(t,x)dt + \int_{T_3}^{T_4} U_{ik}(t,x)dt = \varphi_{ik}(x), \quad k = 1,2,3, \tag{2}$$

$$\int_{T_1}^{T_2} tU_{ik}(t,x)dt + \int_{T_3}^{T_4} tU_{ik}(t,x)dt = \varphi_{ik}(x). \quad i = 1,...,n, \tag{3}$$

$$\int_{T_1}^{T_2} t^2 U_{ik}(t,x)dt + \int_{T_3}^{T_4} t^2 U_{ik}(t,x)dt = \varphi_{ik}(x). \tag{4}$$

Where $a_{ij}\left(\frac{\partial}{\partial x}\right), b_{ij}\left(\frac{\partial}{\partial x}\right), c_{ij}\left(\frac{\partial}{\partial x}\right)$, are differential expression with entire symbols $a_{ij}(\lambda) \neq 0, b_{ij}(\lambda) \neq 0, c_{ij}(\lambda) \neq 0$.

Let be $\eta(\lambda) = \int_{T_1}^{T_2} W^{n-1}(t,\lambda)dt + \int_{T_3}^{T_4} W^{n-1}(t,\lambda)dt$ is a certain function $W(t,\lambda)$ is a solution of equation $\left(\frac{d^n}{dt^n} + \sum_{i=1}^{n} a_i(\lambda) \frac{d^{n-i}}{dt^{n-i}}\right) W(t,\lambda) = 0$, satisfies conditions $W^n(t,\lambda)\Big|_{t=0} = 1, \quad W^{n-1}(t,\lambda)\Big|_{t=0} = 0, \quad W(t,\lambda)\Big|_{t=0} = 0$.

Denote be $P = \left\{ \Delta(\lambda) = 0, \lambda \in \mathbb{C} \right\}$ set zeros of function $\eta(\lambda)$.

Theorem 1. ***Theorem.*** *Let $\varphi_{ik}(x) \in K_L$, $i = 1,...,n$, $j = 1,...,n$ then the class $K_{L \setminus P}$ exist and unique solution of the problem (1)-(4). Solution of the problem (1)-(4) can be represented in the form*

$$U_i(t,x) = \sum_{k=1}^{3} \sum_{p=1}^{n} \varphi_{kp}\left(\frac{\partial}{\partial x}\right) \left\{ \frac{1}{\eta(\lambda)} T_{kjp}(t,\lambda) W(t,\lambda) \exp[\lambda x] \right\} \Bigg|_{\lambda=0},$$

where $T_{kjp}(t,\lambda) = l^T\left(\frac{d}{dt},\lambda\right)$ is transpose of a matrix $\left(\frac{d}{dt},\lambda\right)$.

Solution of the problem (1) - (4) according to the differential-symbol method [1], [2] exists and unique in the class of quasi-polynomials. Be means of the differential-symbol method [1], [2] we construct of the problem (1)-(4). This problem is a continuos works [3] - [6].

References

[1] P.I. Kalenyuk, Z.N. Nytrebych. Generalized Scheme of Separation of Variables. Differential-Symbol Method. *Publishing House of Lviv Polytechnic Natyonaly University*, 2002. – 292 p. (in Ukrainian).

[2] P.I. Kalenyuk, Z.N. Nytrebych, I.V. Kohut, G. Kuduk. Problem for nonhomogeneous evolution equation of second order with homogeneous integral conditions, *Math. Methods and Phys.- Mech. Polia.*, vol. 58, no. 2, (2015), p. 7–19.

[3] G. Kuduk. Problem with integraf conditions for evolution equations of higher order. *International Conference of Young Mathematicians*, 3 - 6 June, 2015, Kyiv, Ukraine, p. 124.

[4] G. Kuduk. Nonlocal problem with integral condition for nonhomogeneous system of evolution equations of second order. *International Scientific Conference "Current problems of Mechanics and Mathematics - 2023" dedicated to 95th birth anniversary of Yaroslav Pidstryhach and 45th anniversary of the Pidstryhach Institute for Applied Problems of Mechanics and Mathematics* May 23 - 25, 2023, Lviv, Ukraine, p. 329-330.

[5] G. Kuduk. Problem with integral conditions for system of partial differential equations of third order. *International Scientific Conference "Current problems of Mechanics and Mathematics - 2023" dedicated to 95th birth anniversary of Yaroslav Pidstryhach and 45th anniversary of the Pidstryhach Institute for Applied Problems of Mechanics and Mathematics. May 23 - 25, 2023, Lviv, Ukraine, p. 331-332.*

[6] G. Kuduk. Problem with integral conditions for nonhomogeneous system of partial differential equations of third order. *XIX International Scientific Mykhailo Kravchuk Conference, dedicated to the 125th anniversary of Igor Sikorsky.* Department of Mathematical Analysis and Probability Theory Igor Sikarski Kyiv Polytechnic Institute. October 11-12, 2023. Ukraine, p. 16 p.

The density of Borromean primes

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My talk is concerned with *Arithmetic Topology*, which investigates the interactions between number theory and 3-dimensional topology. The systematic study of this subject was started by B. Mazur, M. Morishita, M. Kapranov and A. Reznikov etc. As one of the analogies in arithmetic topology, the Legendre symbol can be interpreted as Gauss's linking number ([1, Chapter 4]). In [2], Rédei attempted to generalize Gauss's genus theory and introduced a certain triple symbol $[p_1, p_2, p_3]$ for certain primes p_1, $p_2, p_3 \equiv 1 \bmod 4$. This symbol may be regarded as a triple generalization of the Legendre symbol $(\frac{p_1}{p_2})$, and it describes the decomposition law of p_3 in a certain dihedral extension over $\mathbb{Q}$ of degree 8, which is determined by p_1, p_2. Morishita interpreted the Rédei symbol as an arithmetic analogue of Milnor's triple linking number ([1, Chapter 9]). Now *Borromean primes* in the title is defined as arithmetic analogues of Borromean rings:

Definition 1. The triple of primes $\{p_1, p_2, p_3\}$ is called *Borromean primes* when it satisfies the following conditions:

$$p_i \equiv 1 \bmod 4 \ (i = 1, 2, 3), \quad \left(\frac{p_i}{p_j}\right) = 1 \ (1 \le i \ne j \le 3) \quad \text{and} \quad [p_1, p_2, p_3] = -1.$$

The study of asymptotic distribution of primes goes back to Gauss, and it is viewed as an origin of the so called arithmetic statistics nowadays. Gauss predicted Prime Number Theorem and it