



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

- |  |   |
|--|---|
| • <b>Bolotov D.</b> ( <i>Kharkiv, Ukraine</i> )  | • <b>Konovenko N.</b> ( <i>Odesa, Ukraine</i> )   |
| • <b>Bondarenko V.</b> ( <i>Kyiv, Ukraine</i> )  | • <b>Maksymenko S.</b> ( <i>Kyiv, Ukraine</i> )   |
| • <b>Boychuk O.</b> ( <i>Kyiv, Ukraine</i> )     | • <b>Mikhailets V.</b> ( <i>Kyiv, Ukraine</i> )   |
| • <b>Boyko V.</b> ( <i>Kyiv, Ukraine</i> )       | • <b>Ostrovskiy V.</b> ( <i>Kyiv, Ukraine</i> )   |
| • <b>Cherevko Ye.</b> ( <i>Odesa, Ukraine</i> )  | • <b>Petravchuk A.</b> ( <i>Kyiv, Ukraine</i> )   |
| • <b>Dorogovtsev A.</b> ( <i>Kyiv, Ukraine</i> ) | • <b>Plaksa S.</b> ( <i>Kyiv, Ukraine</i> )       |
| • <b>Drozd Yu.</b> ( <i>Kyiv, Ukraine</i> )      | • <b>Portenko M.</b> ( <i>Kyiv, Ukraine</i> )     |
| • <b>Gerasymenko V.</b> ( <i>Kyiv, Ukraine</i> ) | • <b>Pratsiovytyi M.</b> ( <i>Kyiv, Ukraine</i> ) |
| • <b>Fedchenko Yu.</b> ( <i>Odesa, Ukraine</i> ) | • <b>Savchenko O.</b> ( <i>Kherson, Ukraine</i> ) |
| • <b>Kiosak V.</b> ( <i>Odesa, Ukraine</i> )     | • <b>Romanyuk A.</b> ( <i>Kyiv, Ukraine</i> )     |
| • <b>Kochubei A.</b> ( <i>Kyiv, Ukraine</i> )    | • <b>Timokha O.</b> ( <i>Kyiv, Ukraine</i> )      |

## ORGANIZING COMMITTEE

- |  |   |
|--|---|
| • <b>Maksymenko S.</b> ( <i>Kyiv, Ukraine</i> )  | • <b>Cherevko Ye.</b> ( <i>Odesa, Ukraine</i> ) |
| • <b>Konovenko N.</b> ( <i>Odesa, Ukraine</i> )  | • <b>Osadchuk Ye.</b> ( <i>Odesa, Ukraine</i> ) |
| • <b>Fedchenko Yu.</b> ( <i>Odesa, Ukraine</i> ) | • <b>Sergeeva O.</b> ( <i>Odesa, Ukraine</i> )  |

# Continual distribution with acceleration and condensation flows

Olena Sazonova

(V.N. Karazin Kharkiv National University, Ukraine)

*E-mail:* olena.s.sazonova@karazin.ua

The kinetic equation Boltzmann is the main instrument to study the complicated phenomena in the multiple-particle systems, in particular, rarefied gas. This kinetic integro-differential equation for the model of hard spheres has a form [1, 2]:

$$D(f) = Q(f, f), \quad (1)$$

$$D(f) = \frac{\partial f}{\partial t} + v \frac{\partial f}{\partial x}, \quad (2)$$

$$Q(f, f) = \frac{d^2}{2} \int_{\mathbb{R}^3} dv_1 \int_{\Sigma} d\alpha |(v - v_1, \alpha)| [f(t, v'_1, x) f(t, v', x) - f(t, v_1, x) f(t, v, x)], \quad (3)$$

We will consider the continual distribution [3]:

$$f = \int_{\mathbb{R}^3} \varphi(t, x, u) M(v, u, x, t) du, \quad (4)$$

which contains the local Maxwellian of special form describing the acceleration and condensation flows of a gas (is an analogue of vortices) [4]. They have the form:

$$M(v, u, x, t) = \rho_0 e^{\beta((u - [\omega \times t])^2 + 2[\omega \times x])} \left(\frac{\beta}{\pi}\right)^{\frac{3}{2}} e^{-\beta(v - u - [\omega \times t])^2}. \quad (5)$$

The purpose is to find such a form of the function  $\varphi(t, x, u)$  and such a behavior of all hydrodynamical parameters so that the the uniform-integral (mixed) or pure integral remainder [3, 5], i.e. the functionals of the form:

$$\Delta = \sup_{(t, x) \in \mathbb{R}^4} \int_{\mathbb{R}^3} |D(f) - Q(f, f)| dv, \quad (6)$$

$$\Delta_1 = \int_{R^1} dt \int_{R^3} dx \int_{R^3} |D(f) - Q(f, f)| dv, \quad (7)$$

become vanishingly small.

Also some sufficient conditions to minimization of remainder  $\Delta$  or  $\Delta_1$  are found. The obtained results are new and may be used with the study of evolution of screw and whirlwind streams.

## REFERENCES

- [1] C. Cercignani. *The Boltzman Equation and its Applications*. New York: Springer, 1988.
- [2] M.N. Kogan. *The dynamics of a Rarefied Gas*. Moscow: Nauka, 1967.
- [3] V.D. Gordevskyy, E.S. Sazonova. Continuum analogue of bimodal distributions. *Theor. Math. Phys.*, 171(3) : 839–847, 2012.
- [4] V.D. Gordevskyy. Vortices in a Gas of Hard Spheres. *Theor. Math. Phys.*, 135(2) : 704–713, 2003.

- [5] V.D. Gordevskyy, E.S. Sazonova Continual approximate solution of the Boltzmann equation with arbitrary density. *Mat. Stud.*, 45(2) : 194–204, 2016.

## On a flower-shape geometry

**Raffaella Servadei**

(Dipartimento di Scienze Pure e Applicate  
Università degli Studi di Urbino Carlo Bo)

*E-mail:* raffaella.servadei@uniurb.it

Several important problems arising in many research fields, such as physics and differential geometry, lead to consider elliptic equations when a lack of compactness occurs. From the mathematical point of view, the main interest relies on the fact that often the tools of nonlinear functional analysis, based on compactness arguments, cannot be used, at least in a straightforward way, and some new techniques have to be developed.

Aim of the talk is to present some of these techniques, which strongly use symmetry, together with their applications to elliptic problems with a variational structure. In particular we deal with a group theoretical scheme, raised in the study of problems which are invariant with respect to the action of orthogonal subgroups, and we present a construction, called flower-shape geometry, and its applications to the study of nonlinear problems set in strip-like domains. These results appeared in a joint paper with Giuseppe Devillanova (Politecnico di Bari) and Giovanni Molica Bisci (Urbino).

## On equicontinuity of families of mappings with one normalization condition by the prime ends

**Sevost'yanov Evgeny**

(Zhytomyr Ivan Franko State University; Institute of Applied Mathematics and Mechanics,  
Slavyansk)

*E-mail:* esevostyanov2009@gmail.com

**Ilkevych Nataliya**

(Zhytomyr Ivan Franko State University)

*E-mail:* ilkevych1980@gmail.com

Borel function  $\rho : \mathbb{R}^n \rightarrow [0, \infty]$  is called *admissible* for  $\Gamma$ , abbr.  $\rho \in \text{adm } \Gamma$ , if  $\int_{\gamma} \rho(x) |dx| \geq 1$  for each (locally rectifiable)  $\gamma \in \Gamma$ . We define the quantity

$$M(\Gamma) = \inf_{\rho \in \text{adm } \Gamma} \int_{\mathbb{R}^n} \rho^n(x) dm(x) \quad (1)$$

and call  $M(\Gamma)$  a *modulus* of  $\Gamma$ ; here  $m$  stands for the  $n$ -dimensional Lebesgue measure, see [1, 6.1].

Given sets  $E$  and  $F$  and a domain  $D$  in  $\overline{\mathbb{R}^n} = \mathbb{R}^n \cup \{\infty\}$ , we denote  $\Gamma(E, F, D)$  the family of all paths  $\gamma : [0, 1] \rightarrow \overline{\mathbb{R}^n}$  joining  $E$  and  $F$  in  $D$ , that is,  $\gamma(0) \in E$ ,  $\gamma(1) \in F$  and  $\gamma(t) \in D$  for all  $t \in [0, 1]$ .

<b>E. Petrov, R. Salimov</b> <i>Fixed point theorem for mappings contracting perimeters of triangles and its generalizations</i>	<b>84</b>
<b>A. Prishlyak</b> <i>Structure of codimensional one flows on the 2-sphere with holes</i>	<b>86</b>
<b>A. Arman, A. Bondarenko, A. Prymak</b> <i>Convex bodies of constant width with exponential illumination number</i>	<b>88</b>
<b>G. Riabov</b> <i>Bifurcation points in random dynamical systems</i>	<b>89</b>
<b>D. Ryabogin</b> <i>On symmetries of sections of convex bodies</i>	<b>90</b>
<b>A. Savchenko</b> <i>Fuzzy metrization of spaces of <math>\star</math>-measures</i>	<b>91</b>
<b>O. Sazonova</b> <i>Continual distribution with acceleration and condensation flows</i>	<b>92</b>
<b>R. Servadei</b> <i>On a flower-shape geometry</i>	<b>93</b>
<b>E. Sevost'yanov, N. Ilkevych</b> <i>On equicontinuity of families of mappings with one normalization condition by the prime ends</i>	<b>93</b>
<b>O. Shugailo</b> <i>Equiaffine immersions of codimension two with flat connection</i>	<b>95</b>
<b>H. Sinyukova</b> <i>Some vanishing theorems of sufficient character about holomorphically projective mappings of Kahlerian spaces on the whole</i>	<b>97</b>
<b>A. Skryabina, P. Stegantseva</b> <i>Investigation of the connection between different models of topologies on a finite set</i>	<b>98</b>
<b>R. Skuratovskii</b> <i>Normal subgroups of iterated wreath products of symmetric groups and alternating with symmetric groups</i>	<b>99</b>
<b>A. Serdyuk, I. Sokolenko</b> <i>Asymptotic behavior of the widths of classes of the generalized Poisson integrals</i>	<b>102</b>
<b>A. Bodin, P. Popescu-Pampu, M.-S. Sorea</b> <i>Poincaré-Reeb graphs of real algebraic domains</i>	<b>104</b>
<b>D. Dmytryshyn, D. Gray, and A. Stokolos</b> <i>On univalent trinomials</i>	<b>105</b>
<b>Kh. Sukhorukova</b> <i>On <math>K</math>-ultrametrics and <math>\ast</math>-measures</i>	<b>106</b>
<b>S. Tateno</b> <i>The Iwasawa invariants of <math>Z_p^d</math>-covers of links</i>	<b>106</b>
<b>A. Teleman</b> <i>The Riemann-Hilbert problem and holomorphic bundles framed along a real hypersurface</i>	<b>107</b>
<b>Y. Teplitskaya</b> <i>About some Steiner trees</i>	<b>109</b>
<b>J. Ueki</b> <i>The multiplicities of non-acyclic <math>SL_2</math>-representations and <math>L</math>-functions of twisted Whitehead links</i>	<b>110</b>
<b>J. F. Peters, T. Vergili</b> <i>Proximal connectedness. Spatially and descriptively connected spaces</i>	<b>111</b>