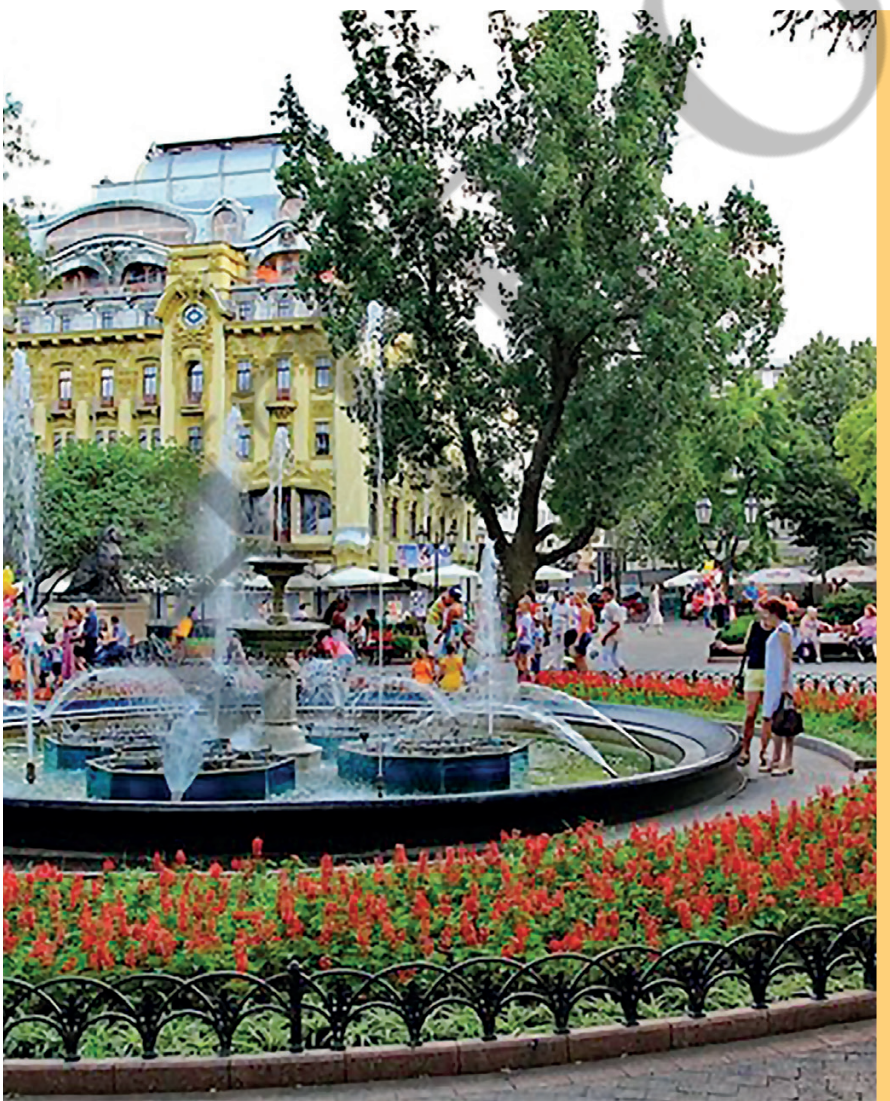
International
Scientific Conference

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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- 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

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Car+trailers' systems are locally nilpotentizable (a Trieste 2000 conference revisited)

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A car towing a number of passive idealized trailers is a classical kinematical model visualising so-called Goursat distributions. In the description of that series of models (indexed by the number of trailers) there are used trigonometric functions of angles between neighbouring trailers and between the car and its closest trailer. This heavily obscures the algebraic side of the models: the generated control Lie algebra is clearly not nilpotent and infinite-dimensional. Hector Sussmann asked in 1998 if the car+trailers' kinematical systems were nilpotentizable. We presented a positive answer to that question at a Trieste 2000 conference. However, recent scientific meetings show that that our result is not quite known... The aim of the talk is to make better known that result and to sketch our [old] proof of it.

References

[1] Piotr Mormul. Goursat flags: classification of codimension-one singularities. *Journal of Dynamical and Control Systems*, 6(3) : 311–330, 2000.

[2] Piotr Mormul. Minimal nilpotent bases for Goursat distributions of coranks not exceeding six. *Universitatis Iagellonicae Acta Mathematica*, 42 : 15–29, 2004.

Degree theory for proper C^1 Fredholm mappings with applications to boundary value problems on the half line

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We overview elements of the definition and several properties, of a degree theory for proper C^1 Fredholm mappings of index zero [1, 2]. We establish sufficient conditions for solvability of an ODE system $\dot{v} + g(t, w) = f_1(t)$, $\dot{w} + h(t, v) = f_2(t)$ under various boundary conditions on the half line. Note that the unbounded domain prevents the use of Leray-Schauder degree. We establish sufficient conditions for solvability of a semilinear parabolic PDE $u_t - A(t)u + F(t, x, u) = f(t, x)$, once again with conditions at $t = 0$ and as $t \to \infty$. These applications illustrate methods to meet the conditions associated with the degree theory, including smoothness, properness, the Fredholm property, and the establishment of *a priori* bounds. (Note: this is an exposition of work previously published [3, 4].)

References

[1] P.M Fitzpatrick, J. Pejsachowicz and P.J. Rabier. The degree of proper C^2 Fredholm mappings. *Journal für die Reine und Angewandte Mathematik*, 427: 1–33, 1992.

[2] J. Pejsachowicz and P.J. Rabier. Degree theory for C^1 Fredholm mappings of index 0. *Journal d'Analyse Mathématique*, 76: 289–319, 1998.