



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> )  |

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

**Piotr Mormul**

(Institute of Mathematics, University of Warsaw, Banach str. 2, 02-097 Warsaw, Poland)  
*E-mail:* mormul@mimuw.edu.pl

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

**Jason R. Morris**

(Department of Mathematics, SUNY Brockport, Brockport NY 14420, USA)  
*E-mail:* jrmorris@brockport.edu

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  $t \rightarrow \infty$ . 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.

<b>E. Lytvynov</b> <i>Lie structures of the Sheffer group over a Hilbert space</i>	<b>58</b>
<b>R. El Maaouy, D. Bennis, L. Oyonarte, J. R. G. Rozas</b> <i>The Gorenstein flat model structure relative to a semidualizing module</i>	<b>60</b>
<b>O. Makarchuk</b> <i>On the structure of the distribution of one random series.</i>	<b>61</b>
<b>S. Maksymneko</b> <i>Homotopy types of diffeomorphisms groups of simplest Morse-Bott foliations on lens spaces</i>	<b>62</b>
<b>Iu. Marko</b> <i>Spaces of idempotent measures with countable support</i>	<b>62</b>
<b>S. Marouaniv</b> <i>SKT hyperbolic and Gauduchon hyperbolic compact complex manifolds</i>	<b>63</b>
<b>N. Mazurenko, M. Zarichnyi</b> <i>Invariant <math>*</math>-measures</i>	<b>66</b>
<b>M. Mhamdi</b> <i>Hölder Continuity of Generalized Harmonic Functions in the Unit Disc</i>	<b>67</b>
<b>Ł. Michalak</b> <i>Reeb graph invariants of Morse functions, manifolds and groups</i>	<b>69</b>
<b>P. Mormul</b> <i>Car+trailers' systems are locally nilpotentizable (a Trieste 2000 conference revisited)</i>	<b>70</b>
<b>J. Morris</b> <i>Degree theory for proper <math>C^1</math> Fredholm mappings with applications to boundary value problems on the half line</i>	<b>70</b>
<b>S. Myroshnychenko, K. Tatarko, V. Yaskin</b> <i>How far apart can the projection of the centroid of a convex body and the centroid of its projection be?</i>	<b>71</b>
<b>M. Nesterenko</b> <i>Contractions of representations and realizations of Lie algebras</i>	<b>73</b>
<b>Yu. Nikolayevsky</b> <i>Geodesic orbit pseudo Riemannian nilmanifolds</i>	<b>74</b>
<b>Z. Novosad, A. Zagorodnyuk</b> <i>The conditions of hypercyclicity of weighted backward shifts</i>	<b>75</b>
<b>T. Obikhod</b> <i>Studying the properties of a superpotential using algebraic equations</i>	<b>76</b>
<b>P. O. Olanipekun</b> <i>On critical submanifolds of the Willmore energy in four dimensions</i>	<b>78</b>
<b>I. Ovtsynov</b> <i>Fermat–Torricelli sets of finite sets of points in Euclidean plane</i>	<b>80</b>
<b>C. A. Pallikaros</b> <i>Degenerations of complex associative algebras of dimension three</i>	<b>82</b>
<b>J. F. Peters, F. Peu, J. Zia</b> <i>Several forms of the geometric Lusternik-Schnirel'mann category</i>	<b>82</b>