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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Corollary 2. *Let, under conditions of Theorem 1,* Γ *denotes the family of all paths joining the segments* $[A,C]$ *and* $[B,D]$ *in* D'*. Then*

$$M(\Gamma)\leqslant \frac{m(D')}{C_0^n}\cdot\frac{1}{|A-B|^n}\,, \tag{4}$$

where M *is the modulus of families of paths defined in (3),* $m(D')$ *denotes the Lebesgue measure of* D'*, and* C_0 *is a constant in (1).*

Corollary 3. *Let, under conditions of Theorem 1,* Γ *denotes the family of all paths joining the segments* $[A,C]$ *and* $[B,D]$ *in* D'*. Then*

$$M(\Gamma)\geqslant \widetilde{c_n}\cdot\log\left(1+\frac{3\delta_*}{8|A-B|}\right)\,, \tag{5}$$

where M *is the modulus of families of paths defined in (3),* $\widetilde{c_n}>0$ *is some constant depending only on* n *and* D'*.*

References

[1] Sevost'yanov E.A. (2022). On logarithmic Hölder continuity of mappings on the boundary. *Annales Fennici Mathematici, 47,* 251–259.

[2] Martio, O., Ryazanov, V., Srebro, U., Yakubov, E. (2009). *Moduli in Modern Mapping Theory.* Springer Monographs in Mathematics. New York etc., Springer.

[3] Martio, O., Ryazanov, V., Srebro, U., Yakubov, E. (2004). Mappings with finite length distortion. *J. d'Anal. Math., 93,* 215–236.

[4] Martio, O., Ryazanov, V., Srebro, U., Yakubov, E. (2005). On Q-homeomorphisms. *Ann. Acad. Sci. Fenn. Math., 30*(1), 49–69 (2005).

Backström curves

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Recall some definitions.

Definition 1. (1) A *non-commutative curve* is a pair $(X,\mathcal{A})$, where X is an algeraic curve over a field $\Bbbk$ and $\mathcal{A}$ is a sheaf of $\mathcal{O}_X$-algebras coherent as a sheaf of $\mathcal{O}_X$-modules.

(2) A non-commutative curve $(X,\mathcal{H})$ is called *hereditary* if for every point $x\in X$ the localization $\mathcal{H}_x$ is hereditary (equivalently, $\operatorname{gl.dim}\mathcal{H}=1$).

(3) A non-commutative curve $(X,\mathcal{A})$ is called *Backström* if there is a hereditary non-commutative curve $(X,\mathcal{H})$ such that $\mathcal{H}\supset\mathcal{A}$ and $\operatorname{rad}\mathcal{H}_x=\operatorname{rad}\mathcal{A}_x$ for all points $x\in X$.

(4) The *Auslander envelope* of a Backström non-commutative curve $(X,\mathcal{A})$ is defined as the non-commutative curve $(X,\tilde{\mathcal{A}})$, where $\tilde{\mathcal{A}}=\mathcal{E}nd_{\mathcal{A}}(\mathcal{A}\oplus\mathcal{H})$.

For instance, every (usual) algebraic curve such that all its singularities are simple nodes is a Backström curve, as well as the union of the coordinate axes in the affine space of any dimension.

We study the structure of Backström curves and their Auslander envelopes and prove the following results.

Theorem 2. *Let $(X, \mathcal{A})$ be a Backström non-commutative curve, $(X, \tilde{\mathcal{A}})$ be its Auslander envelope.*

(1) $\mathrm{gl.dim}\, \tilde{\mathcal{A}} \leq 2$.
(2) $\mathrm{der.dim}\, \mathcal{A} \leq 2$, *where* der.dim $\mathcal{A}$ *denotes the* derived dimension *of* $\mathcal{A}$, *that is the Rouquier dimension* [2] *of the perfect derived category* $\mathcal{D}^{perf}(\mathrm{Coh}\, \mathcal{A})$.

Local versions of these results are proved in [1].

We also study the action of finite groups on Backström curves and prove the following theorem.

Theorem 3. *Let a finite group of order n acts on a Backström curve $(X, \mathcal{A})$ and* $\mathrm{char}\, \Bbbk \nmid n$. *Then the crossed product $(X, \mathcal{A} * G)$ is also a Backström curve and its Auslander envelope is $(X, \tilde{\mathcal{A}} * G)$.*

Some examples will also be presented.

References

[1] Yuriy Drozd. Backström algebras. arXiv: 2206.12875 [mathRT], 2022.
[2] Raphaël Rouquier. Dimensions of triangulated categories. *Journal of K-Theory*, 1(2):193–256, 2008. (to appear in *Pacific J. Math.*)

On geodesic lines of Riemannian metric for Navier-Stokes equations

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Theorem 1. *The 14D Riemann metric in local coordinates*

$$\vec{x} = (x, y, z, t, \eta, \rho, m, u, v, w, p, \xi, \chi, n)$$

$$\begin{aligned}
ds^2 = {} & 2\,dxdu + 2\,dydv + 2\,dzdw + \left(-W(\vec{x},t)w - V(\vec{x},t)v - U(\vec{x},t)u\right) dt^2 + \\
& + \left(-U(\vec{x},t)p - u\left(U(\vec{x},t)\right)^2 - uP(\vec{x},t) + w\mu \frac{\partial}{\partial z}U(\vec{x},t) - wU(\vec{x},t)W(\vec{x},t)\right) d\eta^2 + \\
& + \left(v\mu \frac{\partial}{\partial y}U(\vec{x},t) - vU(\vec{x},t)V(\vec{x},t) + u\mu \frac{\partial}{\partial x}U(\vec{x},t)\right) d\eta^2 + 2\,d\eta d\xi + 2\,d\rho d\chi + 2\,dmdn + \\
& + \left(-V(\vec{x},t)p - vP(\vec{x},t) - v\left(V(\vec{x},t)\right)^2 - V(\vec{x},t)W(\vec{x},t)w + v\mu \frac{\partial}{\partial y}V(\vec{x},t) - uU(\vec{x},t)V(\vec{x},t)\right) d\rho^2 + \\
& + \left(u\mu \frac{\partial}{\partial x}V(\vec{x},t)\right) d\rho^2 + \left(-uU(\vec{x},t)W(\vec{x},t) - w\left(W(\vec{x},t)\right)^2 - wP(\vec{x},t) + w\mu \frac{\partial}{\partial z}W(\vec{x},t)\right) dm^2 + \\
& + \left(v\mu \frac{\partial}{\partial y}W(\vec{x},t) - vV(\vec{x},t)W(\vec{x},t) + u\mu \frac{\partial}{\partial x}W(\vec{x},t) - W(\vec{x},t)p\right) dm^2 \qquad (1)
\end{aligned}$$

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