

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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On 2-convex embeddings of non-orientable surfaces in four-dimensional Euclidean space

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Let us recall the definition of k -convexity of a subset of a Euclidean space (see [1]).

Definition 1. A subset $C \subset E^n$ of Euclidean space is called k -convex if through each point $x \in E^n \setminus C$ there passes a k -dimensional plane that does not intersect C .

Note that the usual convexity corresponds to case $k = n - 1$.

We present the following result.

Theorem 2. *The Projective plane and the Klein bottle do not admit a 2-convex embedding in a four-dimensional Euclidean space if the embedding is assumed to be C^2 -smooth or is a PL-embedding such that the valence of the vertices does not exceed five.*

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Mixing optimization in the batch crystallization of CAM

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The citric acid monohydrate (CAM) is an important organic substance but, until 1997, the scientific literature covered mostly the kinetics of nucleation [4] and the crystal growth [5] rather than its production via the crystallization by cooling in a stirred tank reactor (STR). The Department of Chemical Engineering at the University “La Sapienza” of Rome decided to fill that sci-tech gap through a meticulous investigation, with three STRs at the laboratories of San Pietro in Vincoli’s district, on the crystallization in discontinuous (batch) of CAM from aqueous solutions. The author participated in that cutting edge experience, as experimenter and coder under the supervision of Prof. Barbara Mazzarotta, in the years 1997-1998 [1]. Our specific tasks were to spot the main operating conditions, to modify them until an *optimal* crystal size distribution (CSD), i.e., large-sized homogeneous crystals of CAM, and to write a QBasic program predicting the outcomes of any test in batch reactors [2]. Here we focus on the influence of the *agitation*, i.e., the role played by the impellers in crystallizing the CAM thanks to their different shapes and speeds. All the data, collected and simulated, show that the three-blade marine impeller performs better than the Rushton turbine and that a low stirring rate gives the best CSD [3]. The homogenous distribution of large crystals from a low agitated round-bottomed tank, stirred via a 3-blade marine impeller, is due to the *optimal* suspension state that the axial flow provides for the dispersed phase of CAM particles [6], as confirmed by the computational fluid-dynamics software VisiMix.

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On representation type of incident algebras of extensions of positive posets

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In 1972, P. Gabriel introduced a quadratic form for finite quivers, which was called by him the Tits quadratic form. He proved that a quiver Q is of finite representation type over a field k (i.e., has up to equivalence finitely many indecomposable representations) if and only if its Tits quadratic form is positive. This result laid the foundations of a new direction in the theory of algebras.

In 1974, Yu. A. Drozd showed that a (finite) poset S is of finite representation type if and only if its quadratic Tits form

$$q_S(z) = z_0^2 + \sum_{i \in S} z_i^2 + \sum_{i < j, i, j \in S} z_i z_j - z_0 \sum_{i \in S} z_i$$

is weakly positive, i.e., positive on the non-zero vectors with non-negative coordinates (representations of posets were introduced by L. A. Nazarova and A. V. Roiter in 1972). In contrast to quivers, the posets with weakly positive and with positive Tits forms do not coincide. Since the connected quivers having positive Tits quadratic form coincide with the quivers whose underlying graphs are (simply faced) Dynkin diagrams, the posets with positive Tits form are analogs of the Dynkin diagrams. Such posets, which are simply called positive, were classified by the authors in [1]. Up to isomorphism and duality, the positive posets consist of 5 series and 108 discrete ones.

Since the incidence algebras of positive posets are of finite representation type, it is natural to study representation type of their element-extensions. We consider cases when “new elements” are nodes (in the sense that they are comparable with all other elements). Here we formulate some consequences of our investigation.

A positive poset T is called serial if there exists infinite consequence $T \subset T_1 \subset T_2 \subset \dots$ such that all posets T_i are also positive. By definition, the incidence algebra $\mathcal{I}_k(T)$ of a poset T of order n is the matrix algebra which consists of all matrices $M = (m_{ij})$, $i, j \in T$ (over a field k) such

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