

International
Online Conference



Algebraic
and Geometric
Methods of Analysis

dedicate to the memory
of Yuriy Trokhymchuk
(17.03.1928-18.12.2019)

May 25-28, 2021
Odesa, Ukraine

LIST OF TOPICS

- Topological methods in analysis
- Geometric problems of complex and mathematical analysis
- Algebraic methods in geometry
- Differential geometry in the whole
- Geometry and topology of differentiable manifolds
- General and algebraic topology
- Geometric and topological methods in natural sciences

ORGANIZERS

- Ministry of Education and Science of Ukraine
- Odesa National Academy of Food Technologies
- Institute of Mathematics of the National Academy of Sciences of Ukraine
- Taras Shevchenko National University of Kyiv
- International Geometry Center
- Kyiv Mathematical Society

SCIENTIFIC COMMITTEE

Drozd Yu.

(Kyiv, Ukraine)

Maksymenko S.

(Kyiv, Ukraine)

Plaksa S.

(Kyiv, Ukraine)

Prishlyak A.

(Kyiv, Ukraine)

Bakhtin O.

(Kyiv, Ukraine)

Balan V.

(Bucharest, Romania)

Banakh T.

(Lviv, Ukraine)

Borysenko O.

(Kharkiv, Ukraine)

Cherevko Ye.

(Odesa, Ukraine)

Fedchenko Yu.

(Odesa, Ukraine)

Karlova O.

(Chernivtsi, Ukraine)

Kiosak V.

(Odessa, Ukraine)

Konovenko N.

(Odessa, Ukraine)

Lyubashenko V.

(Kyiv, Ukraine)

Matsumoto K.

(Yamagata, Japan)

Mormul P.

(Warsaw, Poland)

Mykhailyuk V.

(Chernivtsi, Ukraine)

Plachta L.

(Krakov, Poland)

Pokas S.

(Odessa, Ukraine)

Sabitov I.

(Moscow, Russia)

Savchenko O.

(Kherson, Ukraine)

Sergeeva A.

(Odessa, Ukraine)

Shelekhov A.

(Tver, Russia)

Zarichnyi M.

(Lviv, Ukraine)

ADMINISTRATIVE COMMITTEE

- Egorov B., chairman, rector of the ONAFT;
- Povarova N., deputy chairman, Pro-rector for scientific work of the ONAFT;
- Mardar M., Pro-rector for scientific-pedagogical work and international communications of the ONAFT;
- Fedosov S., Director of the International Cooperation Center of the ONAFT;
- Kotlik S., Director of the P.M. Platonov Educational-scientific institute of computer systems and technologies "Industry 4.0";
- Lishchenko N. Dean of faculty of the computer systems and automation ONAFT

ORGANIZING COMMITTEE

Cherevko Ye.
Eftekharinasab K.
Fedchenko Yu.
Feshchenko B.
Khohlyk O.

Klishchuk B.
Konovenko N.
Kravchenko A.
Kuznietsova I.
Maksymenko S.

Osadchuk E.
Plakosh A.
Prus A.
Sergeeva A.
Soroka Yu.

Hyperspaces of convex sets related to idempotent mathematics

Natalia Mazurenko

(Department of Mathematics and Computer Science, Vasyl Stefanyk Precarpathian National University, Shevchenka Str., 57, Ivano-Frankivsk, 76025, Ukraine.)

E-mail: mnatali@ukr.net

Mykhailo Zarichnyi

(Department of Mechanics and Mathematics, Lviv National University, Universytetska Str., 1, Lviv, 79000, Ukraine)

E-mail: zarichnyi@yahoo.com

The notion of hyperspace is one of the most important not only in topology but also in another parts of mathematics. This notion allows us to consider multivalued maps as single valued with the values being points of a hyperspace.

The hyperspace of compact convex sets in compact convex subsets of Euclidean spaces was first considered by Nadler, Quinn, and Stavrokas [4]. They proved, in particular, that the hyperspace of the Euclidean space \mathbb{R}^n , $n \geq 2$, is homeomorphic to the punctured Hilbert cube.

We denote by $x \oplus y$ the coordinatewise maximum of $x, y \in \mathbb{R}^n$. Given $t \in \mathbb{R}$ and $(y_1, \dots, y_n) \in \mathbb{R}^n$, let $t \otimes (y_1, \dots, y_n) = (\min\{t, y_1\}, \dots, \min\{t, y_n\})$. A subset $A \subset \mathbb{R}^n$ is said to be max-min convex if, for any $x, y \in A$ and any $t \in \mathbb{R}$, we have $x \oplus t \otimes y \in A$. It is proved in [3] that the hyperspace of compact max-min convex sets in the Euclidean space \mathbb{R}^n , $n \geq 2$, is homeomorphic to the punctured Hilbert cube.

Following the style of idempotent mathematics we define, for any $t \in \mathbb{R}$ and any $x = (x_1, \dots, x_n) \in \mathbb{R}^n$, $t \odot x = (t + x_1, \dots, t + x_n)$. A subset $A \subset \mathbb{R}^n$ is said to be max-plus convex (see, e.g., [1]) if, for any $x, y \in A$ and any $t \in (-\infty, 0]$, we have $x \oplus t \odot y \in A$. It is proved in [3] that the hyperspace of compact max-min convex sets in the Euclidean space \mathbb{R}^n , $n \geq 2$, is homeomorphic to the punctured Hilbert cube.

Recall that the Fell topology on the hyperspace of closed subsets of a Hausdorff topological space has as a subbase all sets of the form $\{A \mid A \cap V \neq \emptyset\}$, where V is an open subset of X , and also all sets of the form $\{A \mid A \subset W\}$, where W has compact complement. We denote by $\text{Mpcc}_F \mathbb{R}^n$ and $\text{Mmcc}_F \mathbb{R}^n$ the hyperspaces of the max-plus convex and max-min convex nonempty closed (not necessarily bounded) subsets of \mathbb{R}^n endowed with Fell topology. See [5] for description of topology of the hyperspaces of compact convex subsets of \mathbb{R}^n endowed with Fell topology.

Every non-empty closed subset A of a metric space (X, d) can be identified with the distance function $x \mapsto d(x, A)$. The topology of convergence on bounded sets induces the Attouch-Wetts topology on the hyperspace of non-empty closed sets. We denote by $\text{Mpcc}_{AW} \mathbb{R}^n$ and $\text{Mmcc}_{AW} \mathbb{R}^n$ the hyperspaces of the max-plus convex and max-min convex nonempty closed (not necessarily bounded) subsets of \mathbb{R}^n endowed with Attouch-Wetts topology. Some results on ANR-properties of the hyperspaces in the Attouch-Wetts topology can be found in [6].

The aim of the talk is to discuss properties of the hyperspaces $\text{Mpcc}_F \mathbb{R}^n$ and $\text{Mmcc}_F \mathbb{R}^n$, $\text{Mpcc}_{AW} \mathbb{R}^n$, and $\text{Mmcc}_{AW} \mathbb{R}^n$.

REFERENCES

- [1] G. Cohen, S. Gaubert, J. Quadrat, I. Singer. Max-plus convex sets and functions, In: G.L. Litvinov, V.P. Maslov (eds.): *Idempotent Mathematics and Mathematical Physics*. Contemporary Mathematics. American Mathematical Society, 105–129. Also: ESI Preprint 1341, arXiv:math.FA/0308166 (2005)
- [2] L.E. Bazylevych. Hyperspaces of max-plus and max-min convex sets. *Trav. Math.* 18 : 103–110, 2008.
- [3] L.E. Bazylevych. On the hyperspace of max-min convex compact sets. *Methods Funct. Anal. Topology.* 15(4) : 322–332, 2009.

- [4] S.B. Nadler, Jr., J. Quinn, N.M. Stavrokas. Hyperspace of compact convex sets. *Pacif. J. Math.* 83 : 441–462, 1979.
- [5] K. Sakai, Z. Yang. The Spaces of Closed Convex Sets in Euclidean Spaces with the Fell Topology. *Bull. Pol. Acad. Sci. Math.* 55(2) : 139–143, 2007.
- [6] Rostyslav Voytsitskyy. The ANR-property of hyperspaces with the Attouch-Wets topology. *Open Mathematics.* 6(2) : 228–236, 2008.

Kh. F. Kholturayev <i>Perfect metrizable of the functor of idempotent measures</i>	75
Y. Khomych <i>Quasiareal deformation of surfaces of positive Gauss curvature</i>	77
V. Kiosak, O. Lesechko <i>Canonical infinitesimal deformations of metrics of pseudo-Riemannian spaces</i>	78
R. Salimov, B. Klishchuk <i>On the behavior at infinity of ring Q-homeomorphisms</i>	79
T. Kolomiets, A. Pogorui <i>Elements of probability theory and measures with values in hypercomplex algebras</i>	81
N. Konovenko <i>The invariants of planar 3-webs with respect to group of symplectic diffeomorphisms, for the case of the conformal group</i>	84
E. Kudryavtseva <i>Topology of spaces of smooth functions and gradient-like flows with prescribed singularities on surfaces</i>	85
G. Kuduk <i>Nonlocal problem with integral conditions for homogeneous system of partial differential equations of second order</i>	87
I. Kuznietsova, Yu. Soroka <i>Realization of groups as fundamental groups of orbits of smooth maps</i>	88
K. Gürlebeck, D. Legatiuk <i>Modified quaternionic operator calculus and its application to micropolar elasticity</i>	90
S. Maksymenko, E. Polulyakh <i>On non-Hausdorff manifolds of dimension 1</i>	92
S. Maksymenko <i>Symplectomorphisms preserving smooth functions on surfaces</i>	93
M. Maloid-Hliebova <i>Second classical Zariski topology of multiplicative module</i>	94
I. Marko <i>Incomplete spaces of idempotent measures</i>	95
N. Mazurenko, M. Zarichnyi <i>Hyperspaces of convex sets related to idempotent mathematics</i>	96
A. Mednykh <i>Volumes of knots and links in spaces of constant curvature</i>	98
R. Mohseni, R. A. Wolak <i>Twistor spaces on foliated manifolds</i>	99
P. Mormul <i>Two problems in nonholonomic geometry (in quest of a co-worker)</i>	100
F. Mukhamadiev <i>The local τ-density of a linearly ordered spaces</i>	101
T. Obikhod <i>Entropy and phase transitions in Calabi-Yau space</i>	102
A. Orevkova <i>Reducing singularities of smooth functions to normal forms</i>	104
T. Osipchuk <i>On m-convexity and m-semiconvexity of sets in Euclidean spaces</i>	106
V. Ostrovskiy, O. Ostrovska, D. Proskurin, Yu. Samoilenko <i>On representations of q_{ij}-commuting isometries</i>	108
J.F. Peters <i>Homotopic Nerve Complexes with Free Group Presentations</i>	110
P. Laurain, M. Petrace <i>Uniform measures in Euclidean space</i>	112