



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

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## 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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# Fuzzy metrization of spaces of $\star$ -measures

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In [1], a fuzzy metrization of spaces of idempotent measures is constructed. The idempotent measures are known to be counterparts of the probability measures in the idempotent mathematics (see [4] for detailed exposition of topological aspects of idempotent measures).

**Definition 1.** A binary operation  $*$ :  $[0, 1] \times [0, 1] \rightarrow [0, 1]$  is a *continuous t-norm* if it satisfies the following conditions.

- (1)  $*$  is associative and commutative,
- (2)  $*$  is continuous,
- (3)  $a * 1 = a$  for all  $a \in [0, 1]$ ,
- (4)  $a * b \leq c * d$  whenever  $a \leq c$  and  $b \leq d$ , for each  $a, b, c, d \in [0, 1]$ .

**Definition 2.** A 3-tuple  $(X, M, *)$  is said to be a *fuzzy metric space* [2] if  $X$  is an arbitrary set,  $*$  is a continuous t-norm and  $M$  is a fuzzy set on  $X \times X \times (0, \infty)$  satisfying the following conditions for all  $x, y, z \in X$  and  $s, t \in (0, \infty)$ :

- (1)  $M(x, y, t) > 0$ ;
- (2)  $M(x, y, t) = 1$  if and only if  $x = y$ ;
- (3)  $M(x, y, t) = M(y, x, t)$ ;
- (4)  $M(x, y, t) * M(y, z, s) \leq M(x, z, t + s)$ ;
- (5) the function  $M(x, y, \cdot): (0, \infty) \rightarrow [0, 1]$  is continuous.

If  $(X, M, *)$  is a fuzzy metric space,  $(M, *)$  will be called a fuzzy metric on  $X$ .

Let  $\star$  be a triangular norm. A functional  $\mu: C(X, [0, 1]) \rightarrow [0, 1]$  is said to be an  $\star$ -measure if the following holds ( $c_X$  is the constant function with value  $c$ ):

- (1)  $\mu(c_X) = c$  for all  $c \in [0, 1]$ ;
- (2)  $\mu(\varphi \oplus \psi) = \mu(\varphi) \oplus \mu(\psi)$ ;
- (3)  $\mu(\lambda \star \varphi) = \lambda \star \mu(\varphi)$ .

(Here,  $\oplus$  denotes the max operation.)

The spaces  $I^\star(X)$  of  $\star$ -measures on compact Hausdorff spaces  $X$  are endowed with the weak\* topology [3].

The aim of the talk is to provide a fuzzy metrization of the spaces  $I^\star(X)$  on fuzzy metric spaces  $(X, M, *)$ . To this end, we identify the spaces  $I^\star(X)$  with subsets of the hyperspace of  $X \times [0, 1]$ . Our results are analogs of those in [1].

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<b>E. Petrov, R. Salimov</b> <i>Fixed point theorem for mappings contracting perimeters of triangles and its generalizations</i>	<b>84</b>
<b>A. Prishlyak</b> <i>Structure of codimensional one flows on the 2-sphere with holes</i>	<b>86</b>
<b>A. Arman, A. Bondarenko, A. Prymak</b> <i>Convex bodies of constant width with exponential illumination number</i>	<b>88</b>
<b>G. Riabov</b> <i>Bifurcation points in random dynamical systems</i>	<b>89</b>
<b>D. Ryabogin</b> <i>On symmetries of sections of convex bodies</i>	<b>90</b>
<b>A. Savchenko</b> <i>Fuzzy metrization of spaces of <math>\star</math>-measures</i>	<b>91</b>
<b>O. Sazonova</b> <i>Continual distribution with acceleration and condensation flows</i>	<b>92</b>
<b>R. Servadei</b> <i>On a flower-shape geometry</i>	<b>93</b>
<b>E. Sevost'yanov, N. Ilkevych</b> <i>On equicontinuity of families of mappings with one normalization condition by the prime ends</i>	<b>93</b>
<b>O. Shugailo</b> <i>Equiaffine immersions of codimension two with flat connection</i>	<b>95</b>
<b>H. Sinyukova</b> <i>Some vanishing theorems of sufficient character about holomorphically projective mappings of Kahlerian spaces on the whole</i>	<b>97</b>
<b>A. Skryabina, P. Stegantseva</b> <i>Investigation of the connection between different models of topologies on a finite set</i>	<b>98</b>
<b>R. Skuratovskii</b> <i>Normal subgroups of iterated wreath products of symmetric groups and alternating with symmetric groups</i>	<b>99</b>
<b>A. Serdyuk, I. Sokolenko</b> <i>Asymptotic behavior of the widths of classes of the generalized Poisson integrals</i>	<b>102</b>
<b>A. Bodin, P. Popescu-Pampu, M.-S. Sorea</b> <i>Poincaré-Reeb graphs of real algebraic domains</i>	<b>104</b>
<b>D. Dmytryshyn, D. Gray, and A. Stokolos</b> <i>On univalent trinomials</i>	<b>105</b>
<b>Kh. Sukhorukova</b> <i>On <math>K</math>-ultrametrics and <math>\ast</math>-measures</i>	<b>106</b>
<b>S. Tateno</b> <i>The Iwasawa invariants of <math>Z_p^d</math>-covers of links</i>	<b>106</b>
<b>A. Teleman</b> <i>The Riemann-Hilbert problem and holomorphic bundles framed along a real hypersurface</i>	<b>107</b>
<b>Y. Teplitskaya</b> <i>About some Steiner trees</i>	<b>109</b>
<b>J. Ueki</b> <i>The multiplicities of non-acyclic <math>SL_2</math>-representations and <math>L</math>-functions of twisted Whitehead links</i>	<b>110</b>
<b>J. F. Peters, T. Vergili</b> <i>Proximal connectedness. Spatially and descriptively connected spaces</i>	<b>111</b>