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«Algebraic and geometric methods  
of analysis»

Book of abstracts



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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 problems in mathematical analysis
- Geometric and topological methods in natural sciences
- History and methodology of teaching in mathematics

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НТБ ОНАФТ

# Fractal properties of sets associated with Markov representation of real numbers defined by a double stochastic matrix

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Let  $A = \{0, 1\}$  be a number system alphabet,  $q = (q_0, q_1)$  be an ordered set of positive numbers, such that  $q_0 + q_1 = 1$ ,  $L = A \times A \times \dots$  be a sequence space, and

$$Q = ||q_{ik}|| = \begin{pmatrix} q_{00} & q_{01} \\ q_{10} & q_{11} \end{pmatrix} = \begin{pmatrix} a & 1-a \\ 1-a & a \end{pmatrix}$$

be a double stochastic matrix (a matrix having nonnegative elements and such that the sum of elements in each row and each column equals 1), where  $0 < a < 1$ .

Define an interval system of the first rank being a partition of  $[0; 1]$ :

$$[0; 1] = \Delta_0 \cup \Delta_1, \text{ where } \Delta_0 = [0; q_0]; \Delta_1 = [q_0; 1]$$

An interval system of the rank  $n$  ( $n \geq 2$ ) is defined by the follows conditions:

1.  $\Delta_{c_1 c_2 \dots c_m} = \Delta_{c_1 c_2 \dots c_m 0} \cup \Delta_{c_1 c_2 \dots c_m 1}$ ;
2.  $\min \Delta_{c_1 c_2 \dots c_m (i+1)} = \sup \Delta_{c_1 c_2 \dots c_m i}$ ,  $i = \{0, 1\}$ ;
3.  $\frac{|\Delta_{c_1 \dots c_m ij}|}{|\Delta_{c_1 \dots c_m}|} = q_{ij}$ ;
4. for any sequence  $(c_m) \in L$  the intersection  $\bigcap_{m=1}^{\infty} \Delta_{c_1 c_2 \dots c_m} = x \equiv \Delta_{c_1 c_2 \dots c_m \dots}$  is a point of  $[0; 1]$ .

A symbolic representation  $\Delta_{c_1 c_2 \dots c_m \dots}$  of a number  $x \in [0; 1]$  is called its *Markov representation*.

**Theorem 1.** *The set*

$$C = \{x : x = \Delta_{c_1 c_2 \dots c_n \dots}, c_{2k-1} c_{2k} \in \{00, 11\} \forall k \in \mathbb{N}\} \text{ is}$$

*the set of Lebesgue measure zero. Its Hausdorff-Besikovitch dimension is a unique solution of the following equation*

$$a^x (a^x + (1-a)^x) = 1.$$

**Theorem 2.** *The set*

$$D = \{x : x = \Delta_{c_1 c_2 \dots c_n \dots}, c_k + c_{k+1} + c_{k+2} \neq 1 \forall k \in \mathbb{N}\} \text{ is}$$

*the set of Lebesgue measure zero. Its Hausdorff-Besikovitch dimension is a unique the solution of the following equation*

$$(a(1-a)^2)^x + a^x = 1.$$

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