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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

The extremal problem for the area of an image of a disc

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Let Γ be a family of curves γ in the complex plane \mathbb{C} . A Borel function $\varrho : \mathbb{C} \rightarrow [0, \infty]$ is called *admissible* for Γ , abbr. $\varrho \in \text{adm } \Gamma$, if

$$\int_{\gamma} \varrho(z) |dz| \geq 1$$

for all $\gamma \in \Gamma$. The p -modulus of Γ is the quantity defined by

$$\mathcal{M}_p(\Gamma) = \inf_{\varrho \in \text{adm } \Gamma} \int_{\mathbb{C}} \varrho^p(z) dx dy, \quad p \geq 1.$$

Let E, F and G be arbitrary sets in \mathbb{C} . Denote by $\Delta(E, F, G)$ a family of all continuous curves $\gamma : [a, b] \rightarrow \mathbb{C}$ joining E and F in G , i.e. $\gamma(a) \in E, \gamma(b) \in F$ and $\gamma(t) \in G$ for $a < t < b$. Given a domain $D \subset \mathbb{C}$ and $z_0 \in D$, denote by $\mathbb{A}(z_0, r_1, r_2) = \{z \in \mathbb{C} : r_1 \leq |z - z_0| \leq r_2\} < d_0$, where $d_0 = \text{dist}(z_0, \partial D)$.

Now let $Q : D \rightarrow [0, \infty]$ be a (Lebesgue) measurable function. A homeomorphism $f : D \rightarrow \mathbb{C}$ is called a *ring Q -homeomorphism with respect to p -modulus* at $z_0 \in D$, if

$$\mathcal{M}_p(\Delta(fS_1, fS_2, fD)) \leq \int_{\mathbb{A}} Q(z) \eta^p(|z - z_0|) dx dy$$

for every ring $\mathbb{A} = \mathbb{A}(z_0, r_1, r_2)$, $0 < r_1 < r_2 < d_0$, and every measurable function $\eta : (r_1, r_2) \rightarrow [0, \infty]$ such that $\int_{r_1}^{r_2} \eta(r) dr \geq 1$.

Let $\mathbb{B} = \{z \in \mathbb{C} : |z| \leq 1\}$ and $Q : \mathbb{B} \rightarrow [0, \infty]$ be a (Lebesgue) measurable function. For $p > 2$ denote by \mathcal{H} a set of all ring Q -homeomorphisms $f : \mathbb{B} \rightarrow \mathbb{C}$ with respect to p -modulus at the origin satisfying

$$q(t) = \frac{1}{2\pi t} \int_{S_t} Q(z) |dz| \leq q_0 t^{-\alpha}, \quad q_0 \in (0, \infty), \quad \alpha \in [0, \infty),$$

for almost all $t \in (0, 1)$. Here $S_t = \{z \in \mathbb{C} : |z| = t\}$. Let $\mathbf{S}_r(f) = |fB_r|$ be an area functional over the class \mathcal{H} where $B_r = \{z \in \mathbb{C} : |z| \leq r\}$. The following statement provides an extremal bound for the functional $\mathbf{S}_r(f)$.

Theorem 1. For all $r \in [0, 1]$

$$\min_{f \in \mathcal{H}} \mathbf{S}_r(f) = \pi \left(\frac{p-2}{\alpha+p-2} \right)^{\frac{2(p-1)}{p-2}} q_0^{\frac{2}{2-p}} r^{\frac{2(\alpha+p-2)}{p-2}}.$$

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