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Algebraic and Geometric Methods of Analysis

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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

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ІНТЕРНАЦІОНАЛЬНИЙ ЦЕНТР СПІВРОБОТИ

Topology of flows with collective dynamics on surfaces

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We investigate the topological structure of flows with collective dynamics on the sphere. Flows with fixed points of hyperbolic type and focus in which there is one heteroclinic (or as a partial case homoclinic) cycle which divides a surface into two parts and contains all saddle points are considered. One part is connected, homeomorphic to the open disk and has Hamiltonian-type dynamics with focus inside, and the other is divided into regions that have gradient-like dynamics and the same properties as the Morse field. Namely: 1) all points of hyperbolic type; 2) there are no trajectories connecting the saddles, except for trajectories belonging to the selected heteroclinic cycle; 3) each trajectory begins and ends at a fixed point (sink, source, saddle). A complete topological invariant of these flows is constructed.

This invariant is a planar graph, which has the form of a circle with some segments drawn inside it. The circle (the selected cycle on the graph) corresponds to a closed trajectory in the Hamiltonian region, which is quite close to the selected heteroclinic cycle. The vertices correspond to the saddle points and sources, and the saddle lying on the boundary of the two components of the connectivity of the gradient region corresponds to two vertices. Segments (edges that do not belong to the selected cycle) correspond to separatrices coming from a source and chords connecting vertices corresponding to one saddle. By sequentially numbering the vertices on the circle, we divide them into groups and selected pairs. One group includes those vertices of the saddle, which include separatrices from one source (we mark it as $(1,2,3)$), the chords correspond to the numbers of pairs of vertices (we mark it as $\{1,2\}$). Using these invariants, all possible structures of such flows with no more than 6 saddles were found. Thus there is a single flow with one saddle: (1). Two flows with two saddles are 1): (1), (2) and 2): (1,2). Four flows with three saddles are: 1): (1), (2), (3); 2): (1,2), (3); 3): (1,2,3); 4): (1), (3), $\{2,4\}$. 18 flows with 5 saddles and 47 flows of different structure with 6 saddles were also found.

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I. Kuznietsova, S. Maksymenko <i>On the squares of diffeomorphisms of surfaces</i>	40
K. Matsumoto <i>A recurrent (CHR)-curvature tensor field in a trans-Sasakian manifold</i>	41
N. Mazurenko, M. Zarichnyi <i>Spaces of probability measures and box dimension</i>	43
L. Michalak <i>Framed cobordism of systems of submanifolds in the classification of free quotients</i>	44
F. G. Mukhamadiev <i>The density and the τ-placed of the N_τ^φ-nucleus of a space X</i>	45
I. V. Mykytyuk <i>Ricci-flat Kähler metrics on tangent bundles of rank-one symmetric spaces of compact type</i>	47
A. Y. Narmanov, A. N. Zoyidov <i>On the group of isometries of foliated manifolds</i>	49
I. Petkov, V. Ryazanov <i>On boundary behavior by prime ends of solutions to Beltrami equations</i>	50
L. Plachta <i>Some topological obstructions for strong coloring of uniform hypergraphs</i>	51
S. Maksymenko, E. Polulyakh <i>On quotient spaces and their spaces of continuous maps</i>	53
A. Prishlyak, A. Prus <i>Topology of flows with collective dynamics on surfaces</i>	54
V.M. Prokip <i>On similarity of two families of matrices over a field</i>	56
A. M. Romaniv, N. S. Dzhaliuk <i>Some connections between invariant factors of matrix and its submatrix</i>	57
Y. Sachkov <i>Conjugate time in sub-Riemannian problem on Cartan group</i>	58
A. Sadullaev, F. Mukhamadiev <i>The density and the local density of the space of permutation degree</i>	59
U. Samanta <i>A short note on Hurewicz and \mathcal{L}-Hurewicz properties in topological spaces</i>	60
O. Sazonova <i>About one class of Continual distributions with screw modes</i>	62
A. Serdyuk, T. Stepanyuk <i>Asymptotically best possible Lebesgue inequalities on the classes of generalized Poisson integrals</i>	64
A. Ya. Narmanov, X. F. Sharipov <i>Differential invariants of transformations group</i>	66
S. Som, A. Bera, L. K. Dey <i>Some remarks on the Metrizable of F-metric spaces</i>	67
V. Starodub, R. Skuratovskii <i>Triangle Cubics and Conics</i>	69
T. P. Mokritskaya, A. V. Tushev <i>On some fractal-based estimations of subsidence volume for various types of soils</i>	71
Jun Ueki <i>Non-acyclic SL_2-representations of twist knots and non-trivial L-invariants</i>	73