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Morse-Smale flows on torus with hole

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We consider the Morse-Smale flows. Let consider the torus with a hole and Morse-Smale flows [1] on it. Similarly Morse-Smale flows on closed surfaces those flows also are structurally stable and form an open everywhere dense set of all flows on the surface with boundary [2] .

For a torus with hole there exist two separatrices, cutting through which we obtain a simply connected domain. Boundary of this area can be viewed as a circle containing this separatrix. Others separatrices can be considered as the chords on the circle.

Describe the process of transformation diagrams

Diagram can cut along a chord, obtained curvilinear polygons can glue along one pair of separatrices on the circle. Obtained curvilinear polygon again can be considered as chord diagram.

Two diagrams are called equal if one of them can be obtained from another by rotation or symmetry and called equivalent if one of them can be obtained from another by a process of transformation diagrams.

Theorem 1. *Two Morse-Smale flows are equivalent iff their diagrams are equivalent.*

For torus with hole and with 8 singular points(on the boundary) we obtained a set of 106 possible diagrams, but it was found that a large number of diagrams are equivalent. As a result, we obtained 18 equivalence classes hence we counted the number of topological non-equivalent Morse-Smale flows on this surface.

Rerefences

[1] M.J Pacifico. *Stability of Morse-Smale vector fields on manifolds with boundary* Journal of Differential Equations 54(3):346-372 · September 1984.

[2] Jacob PalisJr., Welington de Melo *Genericity and Stability of Morse-Smale Vector Fields* Geometric Theory of Dynamical Systems ISBN 978-1-4612-5703-5