Gutierrez-Sotomayor Flows on Singular Surfaces

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Abstract: Lyapunov graphs have shown to be a useful combinatorial tool which on the one hand, provides means of creating a plethora of flows on surfaces. On the other hand, they are helpful in characterizing topological obstructions that may occur in the dynamics of a given class of vector fields. In some cases, greater insight on the connection between singularities and the α, ω-limits of orbits is obtained.

In this work, we study a problem regarding the Lyapunov graphs associated to Gutierrez-Sotomayor singular flows (GS flows, for short), which is posed as follows. Starting from a Lyapunov function associated to a GS flow tangent to a closed singular 2-manifold, one constructs a Lyapunov graph by collapsing connected components of level sets to distinct points. The vertices and edges of such graphs are labelled, respectively, with topological information on the singularities of the GS flow (regular points, cones, cross-caps, double and triple crossing points) and the Betti numbers of the level sets of the manifold. The main goal is to determine necessary and sufficient conditions for an abstract graph to be a Lyapunov graph of some GS flow on a closed 2-manifold. This is done by using several homotopical tools, among which the Conley index plays an important role.

Joint work with: Ketty Abaroa de Rezende, Nivaldo Grulha and Dahisy Lima.

References

[1] M. A. J. ZIGART, K. A. de REZENDE, N. G. GRULHA Jr, and D. V. S. LIMA, Gutierrez-Sotomayor Flows on Singular Surfaces. arXiv preprint arXiv:2009.14823 (2020)