Global Topological Configurations of Singularities for the Whole Family of Quadratic Differential Systems

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Abstract

In Artés et al. (Geometric configurations of singularities of planar polynomial differential systems. A global classification in the quadratic case. Birkhäuser, Basel, 2019) the authors proved that there are 1765 different global geometrical configurations of singularities of quadratic differential systems in the plane. There are other 8 configurations conjectured impossible, all of them related with a single configuration of finite singularities. This classification is completely algebraic and done in terms of invariant polynomials and it is finer than the classification of quadratic systems according to the topological classification of the global configurations of singularities, the goal of this article. The long term project is the classification of phase portraits of all quadratic systems under topological equivalence. A first step in this direction is to obtain the classification of quadratic systems under topological equivalence of local phase portraits around singularities. In this paper we extract the local topological information around all singularities from the 1765 geometric equivalence classes. We prove that there are exactly 208 topologically distinct global topological configurations of singularities for the whole quadratic class. The 8 global geometrical configurations conjectured impossible do not affect this number of 208. From here the next goal would be to obtain a bound for the number of possible different phase portraits, modulo limit cycles.

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Ⓑ Birkhäuser