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Global configurations of singularities for quadratic differential systems with exactly three finite singularities of total multiplicity four

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Abstract. In this article we obtain the *geometric classification* of singularities, finite and infinite, for the two subclasses of quadratic differential systems with total finite multiplicity $m_f = 4$ possessing exactly three finite singularities, namely: systems with one double real and two complex simple singularities (31 configurations) and (ii) systems with one double real and two simple real singularities (265 configurations). We also give here the global bifurcation diagrams of configurations of singularities, both finite and infinite, with respect to the *geometric equivalence relation*, for these classes of quadratic systems. The bifurcation diagram is done in the 12-dimensional space of parameters and it is expressed in terms of polynomial invariants. This gives an algorithm for determining the geometric configuration of singularities for any system in anyone of the two subclasses considered.

Keywords: quadratic vector fields, infinite and finite singularities, affine invariant polynomials, Poincaré compactification, configuration of singularities, geometric equivalence relation.

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1 Introduction and statement of main results

We consider here differential systems of the form

$$\frac{dx}{dt} = p(x,y), \qquad \frac{dy}{dt} = q(x,y), \tag{1.1}$$

where $p,\ q \in \mathbb{R}[x,y]$, i.e. $p,\ q$ are polynomials in $x,\ y$ over $\mathbb{R}$. We call *degree* of a system (1.1) the integer $m = \max\{\deg p, \deg q\}$. In particular we call *quadratic* a differential system (1.1) with $m = 2$. We denote here by **QS** the whole class of real quadratic differential systems.

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