



Reversible nilpotent centers with cubic homogeneous nonlinearities



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ABSTRACT

We provide 13 non-topological equivalent classes of global phase portraits in the Poincaré disk of reversible cubic homogeneous systems with a nilpotent center at origin, which complete the classification of the phase portraits of the nilpotent centers with cubic homogeneous nonlinearities.

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1. Introduction and statement of the results

One of the main problems in the qualitative theory of planar polynomial differential systems, beside determining their limit cycles and their number, is the center-focus problem, i.e. the problem of distinguishing between a center or a focus. The beginning of this problem goes back to Poincaré, who defined a *center* as a singular point with a neighborhood filled with periodic orbits except the singular point.

It is known that if the polynomial differential system has a center at the origin, then there exists a change of variables and a time rescaling (if necessary) which transforms the original system into one of the following

$$\dot{x} = -y + P(x, y), \quad \dot{y} = x + Q(x, y); \quad (1)$$

$$\dot{x} = y + P(x, y), \quad \dot{y} = Q(x, y); \quad (2)$$

$$\dot{x} = P(x, y), \quad \dot{y} = Q(x, y); \quad (3)$$

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