

3–dimensional smooth and piecewise smooth vector fields with invariant spheres

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Let \mathfrak{X} (resp. \mathcal{X}) be the class of 3-dimensional smooth (resp. piecewise smooth) vector fields that admits the first integral $H(x, y, z) = x^2 + y^2 + z^2$ which leaves invariant any sphere centered at the origin. The main goal of this presentation is to show that a linear vector field in the classes \mathfrak{X} and \mathcal{X} does not admit isolated invariant cones. Moreover, it also will be provided that quadratic homogeneous vector fields in both classes can present isolated and non-isolated invariant cones. It shows an important difference between piecewise linear and quadratic homogeneous vector fields in our classes of interest. Finally, we show that a quadratic vector field in \mathcal{X}_2 can have at least 10 isolated invariant surfaces.

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