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Analytic integrability and characterization of centers for generalized nilpotent singular points

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Abstract

A method which provides necessary conditions for obtaining a local analytic integral in a neighborhood of a generalized nilpotent singular point is developed. This method is applied to several classes of generalized nilpotent systems. We obtain sufficient conditions for each case finding an inverse integrating factor or a local first integral defined at the origin. We study which ones of the found cases possess a center at the origin.
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1. Introduction

A classical question for analytic systems of differential equations in the plane is under which conditions the local phase portrait at a singular point p is topologically equivalent to the local phase portrait of the linear part of the system at p. This problem has been solved by Poincaré and Bendixson for hyperbolic singular points, and for elementary singular points i.e. for points having zero determinant and nonzero trace linear part. Another problem is to characterize the local phase portrait at an isolated singular point p. This problem has been solved except if the singular point is a center or a focus by Andreev [1] for nilpotent singular points, and by different authors for degenerate singular points, see [2,8]. The problem of distinguishing between a center and a focus, called the *center problem* remains, in general, open. Another open

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