Analytic integrability of quasi-homogeneous systems via the Yoshida method

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ABSTRACT

The objective of this paper is twofold. First we do a survey on what we call the Yoshida method for studying the analytic first integrals of the quasi-homogeneous polynomial differential systems. After, we apply the Yoshida method for studying the analytic first integrals of all the quasi-homogeneous polynomial differential systems in $\mathbb{R}^3$ of degree 2.

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1. Introduction

In 1983 Haruo Yoshida publishes a number of interesting results (Yoshida, 1983a,b) that establish conditions for the integrability of some classes of differential systems and provide a way of finding first integrals for such systems. Later on several authors, such as Bessis (1990), Furta (1996), Goriely (1996), Llibre and Zhang (2002), Kasperczuk (2007), Liu et al. (2006) and Maciejewski and Przybylska (2017) have continued to develop his ideas to form what we now call the *Yoshida method*.

In essence the method is based on the correspondence between certain characteristic values of the first integrals and others inherent to the differential system (the so-called *Kovalevskaya exponents*), which are calculable in a finite number of steps.

The main purpose of this work is to analyze the capabilities of the Yoshida method as a tool for the integration of quasi-homogeneous differential systems in the space $\mathbb{R}^3$, a class of differential systems