

LIMIT CYCLES OF DISCONTINUOUS PIECEWISE DIFFERENTIAL SYSTEMS SEPARATED BY A STRAIGHT LINE AND FORMED BY CUBIC REVERSIBLE ISOCHRONOUS CENTERS HAVING RATIONAL FIRST INTEGRALS

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Abstract. A lot of attention has been paid in recent years to the study of piecewise differential systems, and more especially in studying the maximum number of limit cycles that these systems can exhibit. In this paper we consider all classes of discontinuous piecewise differential systems with cubic reversible isochronous centers having rational first integrals separated by the straight line $x = 0$.

First, we solve the extension of the second part of the sixteenth Hilbert problem for each of the three classes of discontinuous piecewise differential systems formed by an arbitrary linear center and one of the three cubic reversible isochronous centers. We establish that, depending on the class presented, the maximum number of limit cycles of these classes varies between one and two. Second, by combining the three types of cubic reversible isochronous centers, we obtain six classes of discontinuous piecewise differential systems formed by two cubic reversible isochronous centers. So we solve the extended sixteenth Hilbert problem for all these classes and find the maximum number of limit cycles that such classes can exhibit. Moreover we have reinforced our results by giving examples for each class.

Keywords. Limit cycle, sixteenth Hilbert problem, discontinuous piecewise differential systems, linear center, cubic reversible isochronous centers.

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1 Introduction

Any *planar* polynomial differential system takes the form $\dot{x} = P(x, y)$, $\dot{y} = Q(x, y)$, where $P(x, y)$ and $Q(x, y)$ are polynomial functions, the *degree* of this system is the maximum degree of these polynomials.

The study of the existence and determination of the upper bound of the maximum number of *limit cycles* of planar polynomial differential systems