LIMIT CYCLES OF PLANAR DISCONTINUOUS PIECEWISE LINEAR HAMILTONIAN SYSTEMS WITHOUT EQUILIBRIUM POINTS AND SEPARATED BY IRREDUCIBLE CUBICS

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ABSTRACT. This paper is devoted to study the limit cycles of planar discontinuous piecewise linear Hamiltonian systems without equilibrium points separated by irreducible cubics. We study the limit cycles that intersect the cubic in two or four points. We provide lower bounds for the maximum number of limit cycles intersecting the cubic either in two points, or in four points, or in both classes simultaneously. All the computations of this paper has been verified with the algebraic manipulator mathematica.

1. INTRODUCTION

We recall that a *limit cycle* of a differential system is an isolated periodic orbit in the set of all periodic orbits of this system. It is well-known that among the many problems of the differential systems in the plane one of the most difficult is to finding the best upper bound for the maximum number of limit cycles that a given differential system or a class of differential systems can exhibit, see for instance the 16th Hilbert problem [12, 14, 16]. Here we consider this problem for the planar discontinuous piecewise linear Hamiltonian systems without equilibrium points and separated by irreducible cubics.

Recently an increasing interest appeared for the piecewise differential systems, mainly due to its applications in engineering, mechanics, electric circuits, ... see for instance the books of [1, 3, 25] and the hundreds of references therein. A good deal of that interest is placed in studying the limit cycles of these piecewise differential systems. See for instance the papers dedicated to study the limit cycles of the piecewise linear differential systems separated by a straight line or by other kind of curves. See, without trying to be exhaustive, for instance [2, 6, 7, 8, 9, 10, 11, 17, 18, 19, 20, 24].

In particular in the papers [4, 15, 21] the authors studied the maximum number of limit cycles of piecewise linear centers separated by algebraic curves of the form $y = x^n$, or by a conic, or by a reducible or irreducible cubic curve.

In this paper we consider planar discontinuous piecewise linear Hamiltonian systems without equilibrium points separated by an irreducible cubic. It is known

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