Nonlinear Dynamics and Systems Theory, **22** (3) (2022) 231–242

The Solution of the Second Part of the 16th Hilbert Problem for a Class of Piecewise Linear Hamiltonian Saddles Separated by Conics

R. Benterki *, L. Damene and L. Baymout

Department of Mathematics, University of Mohamed El Bachir El Ibrahimi of Bordj Bou Arŕeridj 34000, El Anasser, Algeria

Received: December 31, 2021; Revised: June 10, 2022

Abstract: In this paper, we study the existence of the maximum number of crossing limit cycles of planar piecewise differential systems formed by linear Hamiltonian saddles. Firstly, we prove that if we separate these systems by either a parabola or hyperbola or an ellipse, they can have at most three crossing limit cycles. Secondly, we provide an example of four crossing limit cycles when these systems have four zones separated by two intersecting straight lines $xy = 0$.

Keywords: *piecewise differential system , limit cycles , linear Hamiltonian saddles , conics.*

Mathematics Subject Classification (2010): 34A36, 34A07, 34C25.

1 Introduction

One of the important and difficult problems in the qualitative study of differential systems is the determination of the existence or non-existence of limit cycles and their position in the plane, the same problem arises for the piecewise linear differential systems separated by an algebraic curve. Planar discontinuous piecewise linear differential systems were firstly studied by Andronov, Vit and Khaikin [1].

Recently, these systems have been of great importance to the mathematical community due to their applicability to modeling and control of the environment, see for example the books [7, 14].

* Corresponding author: mailto:r.benterki@univ-bba.dz