*Dynamics of Continuous, Discrete and Impulsive Systems*
*Series* **A:** *Mathematical Analysis* **28 (2021)** 153-192
 http://www.watam.org

# THE LIMIT CYCLES OF DISCONTINUOUS PIECEWISE LINEAR DIFFERENTIAL SYSTEMS FORMED BY CENTERS AND SEPARATED BY IRREDUCIBLE CUBIC CURVES I

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**Abstract.** In the qualitative theory of the planar discontinuous piecewise linear differential systems one of the main problems is the study of the number of crossing limit cycles that these systems can have. We study the number of crossing limit cycles of discontinuous piecewise linear differential systems formed by centers and separated by an irreducible algebraic cubic curve. We prove that these differential systems only can exhibit 0, 1, 2 or 3 crossing limit cycles having two intersection points with the cubic of separation curve.

**Keywords.** limit cycles, discontinuous piecewise linear differential systems, linear differential centers, irreducible cubic curves.

**AMS (MOS) subject classification:** Primary: 34C29, 34C25, 47H11.

## 1 Introduction

One of the first works studying the discontinuous piecewise linear differential systems in the plane is due to Andronov, Vitt and Khaikin in [1]. Later on these systems became a topic of great interest in the mathematical community due to their applications for modeling real phenomena, see for instance the books [3, 19] and references there quoted.

To determine the non–existence, the existence of limit cycles and their number is one of the big problems in the qualitative theory of the planar differential systems, and in particular of the planar discontinuous piecewise linear differential systems separated by a curve $\Sigma$. In this work we are considering that a *crossing limit cycle* is a periodic orbit isolated in the set of all periodic orbits of the system which has exactly two points on the discontinuity curve $\Sigma$.

The problem of finding the best upper bound for the maximum number of limit cycles that a family of piecewise linear differential systems in the