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Bifurcation of limit cycles in a class of discontinuous piecewise differential systems

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During these last decades the study of discontinuous piecewise differential systems has become an interesting subject of research due to the important applications of this kind of system to model natural phenomena. In the qualitative theory of differential equations, one of the interesting problems is the detection of the number of limit cycles and their configurations which remains open until now, except for very particular families of differential equations. Here we are inspired to study the maximum number of crossing limit cycles of the discontinuous piecewise differential systems separated by a non-regular line and formed by a linear center and one of the four classes of quadratic centers. The main tool used to prove our main results is based on the first integrals of such systems.

Keywords: quadratic centers, linear centers, limit cycles, discontinuous piecewise differential systems.

1. Introduction and statement of the main results

The first one who started in a serious way the study of piecewise differential systems was Andronov together with Vitt and Khaikin [Andronov *et al.*, 1996], when they tried to model natural phenomena. Nowadays these kinds of differential systems are used in biology, control theory, mechanics, economics, ..., see [Coombes, 2008; Di Bernardo *et al.*, 2008; Glendinning & Jeffrey, 2019; Makarenkov & Lamb, 2012]. In the qualitative theory of differential equations, the detection of the maximum number of limit cycles of planar piecewise differential systems is an essential subject of research and in general, it remains an open problem up to now, this problem is restricted to the planar polynomial differential systems is called the second part of the 16th Hilbert's problem that was proposed in 1900 by David Hilbert, among the 23 problems at the International Congress of Mathematicians in Paris. For discontinuous piecewise differential