

Limit cycles of planar piecewise linear differential systems defined on two sectors

Jaume Llibre^{a,*}, João C. Medrado^b, Oscar Ramírez^b

^a*Departament de Matemàtiques, Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Catalonia, Spain.*

^b*Instituto de Matemática e Estatística, Universidade Federal de Goiás, 74001-970 Goiânia, Goiás, Brazil.*

Abstract

In this paper we prove that three is the upper bound for the maximal number of crossing limit cycles of the planar piecewise linear differential systems defined in two sectors when some of the lateral systems has its singular point at the vertex of the sectors. Moreover if one of the lateral systems has its singular point at the vertex of the sectors and the other lateral system has not a singular point of focus type, then the maximum number of crossing limit cycles is two.

Keywords: Piecewise planar linear differential system, limit cycles, continuous vector fields.

2000 MSC: 34C25, 34C07, 37C27.

1. Introduction and statement of the main results

The computation of upper bounds for the number of limit cycles of the family of planar discontinuous piecewise linear differential systems with two zones on the plane separated by a curve has been the subject of many recent papers. For the simplest case, when the separation curve is a straight line, Han and Zhang [8] conjectured in 2010 that this class of systems have at most two limit cycles. Many authors studied this class of differential systems, see for instance [1, 4, 6, 16]. In 2012, Huan and Yang [9] gave a negative answer to this conjecture by means of a numerical example with three limit cycles under a specific configuration. An analytical proof for the existence of these three limit cycles was given by Llibre and Ponce in [13]. Later on other authors obtained also three limit cycles for discontinuous piecewise linear differential systems with two pieces separated by a straight line [2, 3, 7, 11]. Until now to establish the

*Corresponding author

Email addresses: jlllibre@mat.uab.cat (Jaume Llibre), medrado@mat.ufg.br (João C. Medrado), sr.oscar.ramirez@gmail.com (Oscar Ramírez)