NON-EXISTENCE AND UNIQUENESS OF LIMIT CYCLES FOR A CLASS OF 3-DIMENSIONAL PIECEWISE LINEAR DIFFERENTIAL SYSTEMS

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Abstract. In this paper we study the non-symmetric limit cycles for a family of 3-dimensional piecewise linear differential systems with three zeros separated by two parallel planes. For a class of these differential systems we study the non-existence, existence and uniqueness of their limit cycles.

1. Introduction and statement of the main results

As we know, the continuous and discontinuous piecewise smooth differential systems play an important role inside many disciplines, such as control theory, electrical engineering, mechanics, biology and economics, see for instance the papers [1, 5, 12, 13, 15] and the references quoted there.

The maximum number of *limit cycles*, i.e. the periodic orbits isolated in the set of all periodic orbits, for differential systems is the second part of Hilbert's 16th problem. In the last decades there have been extensively studied on the limit cycles of continuous and discontinuous piecewise differential systems in $\mathbb{R}^2$, see [2, 3, 4, 6, 8, 9, 10, 11, 14, 16]. Recently the authors of [17, 18, 19, 21] considered the limit cycles in several cases of the 3-dimensional (3D) piecewise linear differential systems. Freire et al. [7] considered the birth of limit cycles in 3D piecewise linear systems for the relevant case of symmetrical oscillators with the three zones separated by two planes. Llibre et al. [20] studied a one-parameter family of symmetric 3D piecewise linear differential systems, and proved that it has at most 2 limit cycles. But there are no results about the non-symmetric limit cycles in 3D piecewise linear differential systems with three zones.

Consider the piecewise linear differential systems

$$\begin{array}{ll} \dot{\mathbf{x}} = \mathbf{A}\mathbf{x} & \text{in } P_+ \cup R, \\ \dot{\mathbf{x}} = \mathbf{B}\mathbf{x} & \text{in } P_- \cup C \cup P_+, \\ \dot{\mathbf{x}} = \mathbf{C}\mathbf{x} & \text{in } L \cup P_-, \end{array} \tag{1}$$

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