Sociedad
Matemática
Mexicana

Check for
updates

The limit cycles of a class of piecewise differential systems

Imane Benabdallah[1] · Rebiha Benterki[1] · Jaume Llibre[2]

Abstract

In this century many papers have been published on the piecewise differential systems in the plane. The increasing interest for this class of differential systems is motivated by their many applications for modelling several natural phenomena. One of the main difficulties for controlling the dynamics of the planar differential systems consists in determining their periodic orbits and mainly their limit cycles. Hence there are many papers studying the existence or non-existence of limit cycles for the discontinuous and continuous piecewise differential systems. The study of the maximum number of limit cycles is one of the biggest problems in the qualitative theory of planar differential systems. In this paper we provide the maximum number of limit cycles of a class of planar discontinuous piecewise differential systems formed by an arbitrary linear center and an arbitrary quadratic center, separated by the straight line $x = 0$. In general it is a hard problem to find the exact upper bound for the number of limit cycles that a class of differential systems can exhibit. We show that this class of differential systems can have at most 4 limit cycles. Here we also show that there are examples of all types of these differential systems with one, two, three, or four limit cycles.

Keywords Limit cycles · Discontinuous piecewise linear differential systems · Linear centers · Quadratic centers

Mathematics Subject Classification Primary: 34C29 · 34C25 · 47H11

✉ Rebiha Benterki
    r.benterki@univ-bba.dz

    Imane Benabdallah
    imane.benabdallah@univ-bba.dz

    Jaume Llibre
    jllibre@mat.uab.cat

[1] Mathematical Analysis and Applications Laboratory, Department of Mathematics, University Mohamed El Bachir, El Ibrahimi of Bordj Bou Arréridj, 34000 El Anasser, Algeria

[2] Departament de Matematiques, Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Catalonia, Spain

Birkhäuser