Liang, Feng; Romanovski, Valery G.; Zhang, Daoxiang

Limit cycles in small perturbations of a planar piecewise linear Hamiltonian system with a non-regular separation line. (English) Zbl 1392.34028


Summary: We study Poincaré bifurcation for a planar piecewise near-Hamiltonian system with two regions separated by a non-regular separation line, which is formed by two rays starting at the origin and such that the angle between them is $\alpha \in (0, \pi)$. The unperturbed system is a piecewise linear system having a periodic annulus between the origin and a homoclinic loop around the origin for all $\alpha \in (0, \pi)$. We give an estimation of the maximal number of the limit cycles which bifurcate from the periodic annulus mentioned above under $n$-th degree polynomial perturbations. Compared with the results in [F. Liang et al., Nonlinear Anal., Theory Methods Appl., Ser. A, Theory Methods 75, No. 11, 4355–4374 (2012; Zbl 1264.34073)], where a planar piecewise linear Hamiltonian system with a straight separation line was perturbed by $n$-th degree polynomials, one more limit cycle is found. Moreover, based on our Lemma 2.5 we improve the upper bounds on the maximal number of zeros of the first order Melnikov functions derived in [Y. Wang et al., Chaos Solitons Fractals 83, 158–177 (2016; Zbl 1355.34036)].

MSC:

- 34C05 Topological structure of integral curves, singular points, limit cycles of ordinary differential equations
- 34C07 Theory of limit cycles of polynomial and analytic vector fields (existence, uniqueness, bounds, Hilbert’s 16th problem and ramifications) for ordinary differential equations
- 37G15 Bifurcations of limit cycles and periodic orbits in dynamical systems
- 34A36 Discontinuous ordinary differential equations

Keywords:

limit cycle; homoclinic loop; Melnikov function; Chebyshev system; piecewise smooth system

Full Text: DOI

References:
[12] Liang, F.; Han, M.; Romanovski, V. G., Bifurcation of limit cycles by perturbing a piecewise linear Hamiltonian system with


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