

**MULTIPLE PERIODIC SOLUTIONS
FOR ONE-SIDED SUBLINEAR SYSTEMS:
A REFINEMENT OF THE POINCARÉ–BIRKHOFF APPROACH**

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ABSTRACT. In this paper we prove the existence of multiple periodic (harmonic and subharmonic) solutions for a class of planar Hamiltonian systems which includes the case of the second order scalar ODE $x'' + a(t)g(x) = 0$ with g satisfying a one-sided condition of sublinear type. We consider the classical approach based on the Poincaré–Birkhoff fixed point theorem as well as some refinements on the side of the theory of topological horseshoes. A Duffing-type equation and an exponential nonlinearity case are studied as applications.

1. Introduction and statement of the main results

This work deals with the existence and multiplicity of periodic solutions to sign-indefinite nonlinear first order planar systems of the form

$$(1.1) \quad x' = h(y), \quad y' = -a_{\lambda,\mu}(t)g(x).$$

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