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The shape of limit cycles that bifurcate from non-Hamiltonian centers

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1. Introduction

In a previous paper [6] we have introduced a method for computing analytically, up to any order of the bifurcation parameter, the shape of the bifurcated limit cycles from a Hamiltonian center. This method, as far as we know, is the unique explicit procedure in the literature about limit cycles which allows to determine the shape of these bifurcated cycles.

There are four methods for the evaluation of the number of bifurcated limit cycles from a center [1,2,4]. The first one is based on the Poincaré return map, the second on the Poincaré–Melnikov integral method, the third on the abelian integral method and the last is the procedure presented in [6]. In fact, in the plane, the second and the third methods are essentially equivalent. The first three methods only give the orbits of the unperturbed system that turn into limit cycles when the system is perturbed. The method presented in [6] is the only one that also gives the shape of the bifurcated limit cycles, up to any order of the perturbation.

In the present paper, we generalise the results presented in [6]. We compute analytically the global shape of the bifurcated cycles from a non-Hamiltonian center, when we perturb it by an arbitrary analytic planar vector field. This generalisation is not straightforward and presents several technical difficulties.

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