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On the return time function around monodromic polycycles

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Abstract

In this paper we study the period function of centers of planar polynomial differential systems. With a convenient compactification of the phase portrait, the boundary of the period annulus of the center has two connected components: the center itself and a polycycle. We are interested in the behaviour of the period function near the polycycle. The desingularization of its critical points gives rise to a new polycycle (monodromic as well) with hyperbolic saddles or saddle-nodes at the vertices. In this paper we compute the first terms in the asymptotic development of the time function around any orbitally linearizable saddle that may come from this desingularization process. In addition, we use these developments to study the bifurcation diagram of the period function of the dehomogenized Loud's centers. More generally, the tools developed here can be used to study the return time function around a monodromic polycycle. This work is a continuation of the results in [P. Mardešić, D. Marín, J. Villadelprat, On the time function of the Dulac map for families of meromorphic vector fields, Nonlinearity 16 (2003) 855–881; P. Mardešić, D. Marín, J. Villadelprat, The period function of reversible quadratic centers, J. Differential Equations 224 (2006) 120–171].

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1. Introduction and setting of the problem

The present paper deals with planar polynomial differential systems and our goal is to develop tools in order to study the qualitative properties of the period function of a center. Although this

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