# Bifurcation Of Limit Cycles From A Center in $\mathbb{R}^4$ in ressonance 1:N

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RESUMO

In the qualitative theory of differential equations the study of their limit cycles became one of the main topics. For a given differential equation $\mathcal{E}$ a *limit cycle* is a periodic orbit of $\mathcal{E}$ isolated in the set of all periodic orbits of $\mathcal{E}$.

Many questions arise on the limit cycles of the planar differential equations. Two main lines of research for such equations are, first the 16th Hilbert problem see for instance [3, 4], and second the study of how many limit cycles emerge from the periodic orbits of a center when we perturb it inside a given class of differential equations, see for example the book [2] and the references there in. More precisely the problem of consider the planar linear differential center

$$\dot{x} = -y, \qquad \dot{y} = x$$

and perturb it

$$\dot{x} = -y + \varepsilon P(x, y), \qquad \dot{y} = x + \varepsilon Q(x, y),$$

inside a given class of polynomial differential equations and study the limit cycles bifurcating from the periodic orbits of the linear center has been attracted the interest and the research of many mathematicians. Of course $\varepsilon$ is a small parameter. Here our main concerning is to bring this problem to higher dimension.

In this paper, for every positive integer $N \geq 2$, we consider the linear differential center $\dot{x} = Ax$ in $\mathbb{R}^4$ with eigenvalues $\pm i$ and $\pm Ni$. We perturb this linear center inside the class of all polynomial differential systems of the form linear plus a homogeneous nonlinearity of degree $N$, i.e. $\dot{x} = Ax + \varepsilon F(x)$ where every component of $F(x)$ is a linear polynomial plus a homogeneous polynomial of degree $N$. Then if the displacement function of order $\varepsilon$ of the perturbed system is not identically zero, we study the maximal number of limit cycles that can bifurcate from the periodic orbits of the linear differential center.

## Referências

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