Simultaneous bifurcation of limit cycles from a cubic piecewise center with two period annuli

Leonardo P. C. da Cruz

(in collaboration with J. Torregrosa (Universitat Autònoma de Barcelona))

Departament de Matemàtiques, Universitat Autònoma de Barcelona, Barcelona, Spain

Consider the piecewise polynomial vector field

$$Z^{\pm} = \begin{cases} \dot{x} = -y((x-1)^2 + y^2) + \varepsilon P^{\pm}(x,y) \\ \dot{y} = x((x-1)^2 + y^2) + \varepsilon Q^{\pm}(x,y) \end{cases} \quad \text{if } (x,y) \in \Sigma^{\pm},$$

with $P^{\pm}$ and $Q^{\pm}$ polynomials of degree 3 and $\Sigma^{\pm} = \{(x,y) : \pm y > 0\}$. We study the number of periodic orbits that bifurcate, up to a first order averaging analysis, from the two period annuli. This problem is an extension of [1] for piecewise systems. For the particular case $n = 3$ we obtain that the maximum number of limit cycles from the inner and outer annuli is 9. There are examples with 12 limit cycles when the simultaneous bifurcation problem is considered. The upper bound is obtained using some new properties on the number of zeros of linear combination of functions that are Extended Chebyshev systems with some accuracy, see [2].

[1] S. Pérez-González, J. Torregrosa, *Simultaneous bifurcation of limit cycles from a linear center with extra singular points*, Bull. Sci. Math. **138** (2014) 124–138.

[2] D. D. Novaes, J. Torregrosa, *On the Extended Chebyshev systems with positive accuracy.* (2015) (work in progress).