Relaxation Oscillations in Liénard Equations

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Abstract

In this talk, I restrict myself to families of 2-dimensional slow-fast systems of Liénard type. I want to recall how a global blow up at the turning points of the slow curve allows us to obtain a geometric understanding of the canard phenomenon. This blow up is also used to derive a smooth equivalence between the derivative of the Poincaré map along any canard cycle with the rational slow divergence integral function. As a consequence, one can relate the bifurcations of the canard cycle into relaxation oscillations, to the bifurcations of the slow divergence integral function. This reduction result was obtained in collaboration with F. Dumortier for two creation mechanisms of canard cycles : some years ago in the van der Pol bifurcations and more recently in the crossing of contact point values. It is also possible to use partial slow-fast integrals to study more general canard cycles, and for instance 2-level ones.

Using computations on the slow-fast integral, one has obtained in collaboration with D. Panazzolo several examples of Liénard equations having more limit cycles than the number which was conjectured by Lins, de Melo and Pugh.