Relaxation oscillations in slow-fast systems

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The talk deals with two-dimensional slow-fast systems. These systems depend on a small parameter ϵ, and possibly also on other parameters, in a way that for $\epsilon = 0$ the equation has a continuum of singular points.

Such systems can be studied by means of Geometric Singular Perturbation Theory. This theory essentially relies on center manifold reduction. The first to introduce it was Fenichel. Traditional Fenichel theory can however only be used near normally hyperbolic situations. Around 1995 it became clear how the blow technique could extend the power of geometric singular perturbation theory to including contact points.

Center manifolds, normal forms and blow-up permit to treat singular perturbation problems by means of traditional methods from dynamical systems theory.

In the talk we will only shortly recall the essential ingredients from the theory. We will mainly present a number of recent results concerning relaxation oscillations for $\epsilon > 0$, ϵ small: their number, the bifurcations they undergo.

The results come from a number of papers of Robert Roussarie, Peter De Maesschalck and myself.