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More on multi-layer canard cycles.

Based on joint work with Peter De Maesschalck and Robert Roussarie.

Given a slow-fast system containing several layers, we study the canard cycles transiting through these layers. All the canard cycles we consider are topological circles and in between the layers we restrict to generic Hopf breaking mechanisms and generic jump breaking mechanisms.

As shown in previous talks, there is a difference in between transiting a terminal layer or transiting a dodging layer, but maybe more important is the precise way in which successive layers are connected to each other at the breaking mechanism. In order to study the precise passage at such a breaking mechanism we have to compare a transition map coming from an attracting sequence on one side to the transition map coming (in negative time) from a repelling sequence on the other side. The comparison can be side-preserving or side-reversing and this makes a major difference in the calculations, affecting strongly the results on the number of limit cycles and their possible bifurcations.

As already explained in previous talks the equations to consider merely depend on the so-called "connection diagram" associated to the multi-layer canard cycle.

We will provide some general results concerning these equations, leading to precise consequences on the cyclicity and the bifurcations, with emphasis on 2-layer canard cycles. We will present the essential ingredients of the proofs.

We prove that all possible abstract connection diagrams can be realized by a multi-layer canard cycle of a planar polynomial vector field. We also precisely state the conditions under which a connection diagram can be realized by a multi-layer canard cycle of a classical Liénard equation as well as of a generalized polynomial Liénard equation.

We end the talk by giving an overview of problems that we working at.