Title: “On the search for separatrices and basins of attraction in biological systems.”

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Abstract:

Many biological systems can be modelled as dynamical systems given as sets of differential equations or iterations of a map. Often one is interested in finding the stable equilibrium states and periodic solutions of the system.

Most of the standard techniques for this type of problems involve the analysis of local properties of the equations such as to study the linealisation of system near the object of interest. However, typically very little is said about the (global) basins of attraction of the stable objects. Their basin boundaries are formed by the global stable manifolds of equilibria and/or periodic orbits.

Moreover, these global manifolds may change both topologically and geometrically under suitable perturbations of the model parameters at bifurcations, transforming the properties of the basins of attraction they separate.

While in general, one cannot find analytical expressions for global invariant manifolds, there is a number of accurate, reliable, and fast numerical techniques that have surfaced in the last decade. In this talk I will present how the computation of global invariant manifolds shed light on the role of these global objects in the organization of the dynamics in biologically inspired systems, specially in the presence of bifurcations. I will focus on two examples: a predator-prey model with Allee effect, and a laser system showing excitable dynamics which mimics different types of neuron pulsing.