NONAUTONOMOUS DIFFERENTIAL EQUATIONS IN THE PRESENCE OF BOUNDED NOISE

IACOPO P. LONGO

The behaviour of a random dynamical system with bounded noise admits a natural description at the topological level as a (deterministic) set-valued dynamical system, representing the compound behaviour of the underlying random dynamical system, where initial conditions are evolved under all possible realisations of the noise, and detailed information on probability is ignored.

Set-valued dynamical systems are notoriously difficult to analyse, since they act on the set of all compact subsets, which is not a Banach space. Many powerful tools fundamental for bifurcation and singularity theory (such as the implicit function theorem) are not available in this context. This is a well-known obstacle for theoretical and numerical methods alike. As a consequence, the bifurcation analysis of attractors of set-valued dynamical systems is a notoriously hard problem already for autonomous systems. We adapt a novel technique introduced by the dynamical systems group at Imperial College London called the boundary map, which allows to describe the behaviour of invariant sets for autonomous set-valued dynamical systems by simply keeping track of the evolution of their boundary. This approach offers the advantage of recovering the technically familiar framework of finite-dimensional dynamical systems, using well-established tools from dynamical systems theory.