
MAXIME BREDEN, ENS Cachan - Université Laval

Rigorous computation of maximal local (un)stable manifold patches by the parameterization method

I'll present an automatic procedure for computing and validating high order polynomial expansions of local (un)stable manifolds for equilibria of ordinary differential equations. These invariant manifolds are fundamental blocks granting information about the global dynamic of the system. Our aim is to provide a better understanding of the parameterization method within the framework of rigorous computation, and to make it easier to further use the computed manifolds (for instance to prove existence of connecting orbits). The method on which this work is based was already used to rigorously compute connecting orbits with the help of (un)stable manifolds, but because of the lack of systematic procedure to select the various parameters, tedious trial and errors were required for the proof to succeed. I'll explain how the scaling of the eigenvectors can be used in a flexible way to adapt the computation of the manifold to the problem at hand (a fast-slow system for example), and show how to track the influence of the scaling in validation estimates (like the *radii polynomials*), which allows for a cheap optimization scheme for the scaling. An example of a work using this procedure (to prove the existence of traveling waves for the *suspended bridge equation*) will be presented by Maxime Murray in another talk in this session.