Parameterizing asymptotic dynamics with manifolds and bundles

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Abstract

The parameterization method is a powerful technique for computing high-order approximations of invariant manifolds. In it, one fixes simple internal dynamics for the manifold, which then determines how to solve for the Taylor coefficients, yielding an analytic chart. One can generically show the dynamics are conjugate to the linear flow, but like with the Hartman-Grobman theorem, certain eigenvalue resonances, especially in Hamiltonian systems, can provide an obstruction.

This talk will discuss a parameterization approach towards computing the (un)stable vector bundles attached to invariant manifolds, and are important for a detailed understanding of exponential dichotomies. The first application computes spectral stability of a pulse in the Swift-Hohenberg equation by computing the Maslov index of a homoclinic in a Hamiltonian ODE, and overcomes the problem of eigenvalue resonances. The second application aims to tackle the curse of dimensionality in approximating infinite dimensional stable manifolds arising in PDEs, by constructing a low dimensional slow-stable manifold with attached (un)stable bundles.