A parametrized Newton-Kantorovich method for rigorously computing (un)stable manifolds: non-resonant and resonant spectra

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In this talk we present numerical techniques for the rigorous computation of parametrizations for (un)stable manifolds to hyperbolic fixed points of analytic vector fields via the so called parametrization method. We facilitate our analysis by interpreting the infinite sequence of homological equations derived from the invariance equation fulfilled by the parametrization as an equivalent zero finding problem on the space of geometrically decaying sequences. Using this viewpoint an approach to compute rigorous error bounds on approximate parametrizations is presented. It is based on solving an equivalent parametrized fixed point problem on a ball around a numerical approximation using the contraction principle. In particular our analysis is successful even if internal non-resonance conditions crucial to previous methods fail to hold. We finish the talk by showing example implementations.

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