Finite-time Lyapunov exponents in many-dimensional dynamical systems

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Understanding the local Lyapunov instability of generic, i.e. nonhyperbolic, dynamical systems is an important subject of nonlinear molecular systems. We present a new, relatively simple numerical method for computing finite-time Lyapunov exponents and vectors that is accurate, efficient, and applicable even when the system is many dimensional and/or nonhyperbolic, in contrast to the existing methods [Goldhirsch, Sulem, and Orszag. Physica D 27, 311,1987]. Applying our method to a generic many-dimensional interacting oscillators system, we obtain clear evidence that qualitatively different Lyapunov instabilities, of exponential and linear time-dependences, coexist in a trajectory. These results, which can not be detected in general without the use of our accurate method, will be reported in detail on the poster.