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Estimation of Lyapunov exponents of dynamical systems using a spatial average. (English summary)

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Summary: “We present an unconventional method of estimating all of the Lyapunov exponents of a dynamical system from either a known map or a set of experimental data. Rather than averaging exponents along a single trajectory, we instead represent each exponent as an integral over all of phase space. The contribution to each exponent, calculated at each point in phase space, is averaged spatially by weighting areas of high density more heavily than areas of low density, according to the invariant measure of the system. Explicit formulas for approximating both the contributions to the exponents and the invariant measure are given, and convergence results stated. The techniques are illustrated in detail for the Hénon system.”