Rigorous Approximation of stationary Measures and Convergence to Equilibrium for Iterated Function Systems

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We study the problem of the rigorous computation of the stationary measure and of the rate of convergence to equilibrium of an Iterated Function System described by a stochastic mixture of two or more dynamical systems that are either all uniformly expanding on the interval, either all contracting.

In the expanding case, the associated transfer operators satisfy a Lasota-Yorke inequality, we show how to compute a rigorous approximations of the stationary measure in the L1 norm and an estimate for the rate of convergence. The rigorous computation requires a computer-aided proof of the contraction of the transfer operators for the maps, and we show that this property propagates to the transfer operators of the IFS.

In the contracting case we perform a rigorous approximation of the stationary measure in the Wasserstein-Kantorovich distance and rate of convergence, using the same functional analytic approach. We show that a finite computation can produce a realistic computation of all contraction rates for the whole parameter space. We conclude with a description of the implementation and numerical experiments.