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**MR1751564 (2001k:37133)**[Froyland, Gary \(D-PDRB\)](#); [Aihara, Kazuyuki \(J-TOKYO-IP\)](#)**Rigorous numerical estimation of Lyapunov exponents and invariant measures of iterated function systems and random matrix products. (English summary)***Internat. J. Bifur. Chaos Appl. Sci. Engrg.* **10** (2000), *no. 1*, 103–122.[37M25 \(28A80\)](#)

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The authors provide a numerical method of computing the invariant measure and associated Lyapunov exponents of an iterated function system (IFS). In the first part they discuss the approximation of the invariant measure via a discretization of a Perron-Frobenius operator in the case where the IFS is a contraction in average. Here rigorous error bounds are given. The second part is devoted to the calculation of the top Lyapunov exponent of an i.i.d. random product of finitely many matrices. This is done by integration over an invariant measure on the projective space. In the third part the previously developed methods are combined in order to approximate the Lyapunov exponent of a nonlinear contracting-in-average IFS. A rigorous error bound is provided for the case when the system lives on a one-dimensional manifold. Examples are given and the methods are compared with the conventional method of exponent computing via long orbits. For some technical parts of the convergence proofs the authors refer to an unpublished manuscript which is available on the internet [G. Froyland, “On estimating invariant measures and Lyapunov exponents for i.i.d. compositions of maps”, unpublished notes, Tech. Rep., 1998, available at <http://www-math.uni-paderborn.de/~froyland/mypapers.html>].

[Reviewed](#) by [Gunter Ochs](#)

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