

# Computer-assisted proofs, proof assistants and visualization in dynamical systems



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Lower bounds on the Hausdorff dimensions of Julia sets

**Abstract:** We present an algorithm for a rigorous computation of lower bounds on the Hausdorff dimensions of Julia sets for a wide class of holomorphic maps. We apply this algorithm to obtain lower bounds on the Hausdorff dimension of the Julia sets of some infinitely renormalizable real quadratic polynomials, including the Feigenbaum polynomial  $p_{\text{Feig}}(z) = z^2 + c_{\text{Feig}}$ . In addition to that, we construct a piecewise constant function on  $-2, 2$  that provides rigorous lower bounds for the Hausdorff dimension of the Julia sets of all quadratic polynomials  $p_c(z) = z^2 + c$  with  $c \in -2, 2$ . Finally, we verify the conjecture of Ludwik Jaksztas and Michel Zinsmeister that the Hausdorff dimension of the Julia set of a quadratic polynomial  $p_c(z) = z^2 + c$ , is a  $C^1$ -smooth function of the real parameter  $c$  on the interval  $c \in (c_{\text{Feig}}, -34)$ .

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