Chen, Jie; Ngai, Sze-Man
Eigenvalues and eigenfunctions of one-dimensional fractal Laplacians defined by iterated function systems with overlaps. (English) Zbl 1261.35095

Summary: Under the assumption that a self-similar measure defined by a one-dimensional iterated function system with overlaps satisfies a family of second-order self-similar identities introduced by Strichartz et al., we obtain a method to discretize the equation defining the eigenvalues and eigenfunctions of the corresponding fractal Laplacian. This allows us to obtain numerical solutions by using the finite element method. We also prove that the numerical eigenvalues and eigenfunctions converge to the true ones, and obtain estimates for the rates of convergence. We apply this scheme to the fractal Laplacians defined by the well-known infinite Bernoulli convolution associated with the golden ratio and the 3-fold convolution of the Cantor measure. The iterated function systems defining these measures do not satisfy the open set condition or the post-critically finite condition; we use second-order self-similar identities to analyze the measures.

MSC:
35P20 Asymptotic distributions of eigenvalues in context of PDEs
35R02 PDEs on graphs and networks (ramified or polygonal spaces)

Keywords:
eigenvalues; eigenfunctions; fractal Laplacian; self-similar measure; iterated function system with overlaps; second-order self-similar identities; finite element method

Full Text: DOI

References:

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