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The decimation method for Laplacians on fractals: spectra and complex dynamics. (English) [Zbl 1321.58014]

Summary: In this survey article, we investigate the spectral properties of fractal differential operators on self-similar fractals. In particular, we discuss the decimation method, which introduces a renormalization map whose dynamics describes the spectrum of the operator. In the case of the bounded Sierpiński gasket, the renormalization map is a polynomial of one variable on the complex plane. The decimation method has been generalized by C. Sabot to other fractals with blow-ups and the resulting associated renormalization map is then a multi-variable rational function on a complex projective space. Furthermore, the dynamics associated with the iteration of the renormalization map plays a key role in obtaining a suitable factorization of the spectral zeta function of fractal differential operators. In this context, we discuss the works of A. Teplyaev and of the authors regarding the examples of the bounded and unbounded Sierpiński gaskets as well as of fractal Sturm-Liouville differential operators on the half-line.

For the entire collection see [Zbl 1276.00023].

MSC:

58J15 Relations of PDEs on manifolds with hyperfunctions
28A80 Fractals
31C25 Dirichlet forms
32A20 Meromorphic functions of several complex variables
35R02 PDEs on graphs and networks (ramified or polygonal spaces)
37F10 Dynamics of complex polynomials, rational maps, entire and meromorphic functions; Fatou and Julia sets
37F25 Renormalization of holomorphic dynamical systems
82D30 Statistical mechanics of random media, disordered materials (including liquid crystals and spin glasses)

Keywords:
Laplacians on Sierpiński gasket; Riemann zeta function; fractal Sturm-Liouville operators

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