Abstract

In this thesis we study a class of non self-similar fractals $\{K_\alpha : \alpha \in (0, 1/3)\}$, the so–called Hanoi attractors of parameter α. We investigate the geometric and analytic relationships between the Hanoi attractors and the Sierpiński gasket, which is one of the most studied self-similar fractals.

The first part of the thesis treats the problem from a geometric point of view: For each $\alpha \in (0, 1/3)$ we construct the Hanoi attractor K_α and prove that the sequence $(K_\alpha)_\alpha$ converges to the Sierpiński gasket in the Hausdorff metric as α tends to zero. Moreover, we prove convergence of the Hausdorff dimension as α tends to zero.

The second part of the thesis deals with the construction of an analysis on Hanoi attractors. To this end, we introduce an appropriate resistance form on K_α, choose a suitable Radon measure and obtain a local and regular Dirichlet form that acts on the associated L^2-space. This form defines a Laplacian on K_α, whose spectral properties we then investigate.

The study of the asymptotic behaviour of the eigenvalue counting function of this Laplacian allows us to calculate the spectral dimension of K_α, which turns out to coincide with the one of the Sierpiński gasket for all $\alpha \in (0, 1/3)$.