Dimension theory of self-affine systems with singular matrices

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The goals of the thesis

The foundation of fractal theory belongs to Benoit Mandelbrot, who called these irregular and fragmented objects as fractals. There is no proper definition for fractals, but the mathematical society agreed about fractals have unique features.Some fractals can be described via Iterated Function System (IFS), which is a finite collection of contracting maps. There exists a unique non-empty compact set, which is called the Attractor. The determination of the dimension of the attractor of a general iterated function systems and a general graph-directed iterated function systems (GDIFS) is an open problem, but under some conditions, we can determine it. In this thesis we would give conditions to detemine the dimension if the affine mappings of the IFS contains singular matrices.

The structure of the thesis

The thesis consist of 5 chapters; Introduction, Preliminary, Main results, Proofs and Conclusions.

Introduction

In this chapter we show the basics of a fractal set, with some history and examples.

Preliminary

In this chapter we give necessary definitions and theorems which are important for the results of this thesis. We show the definition of the Hausdorff-dimension and some basic properties. Furthermore we state dimension theorems for regular IFS.

Main results

In this chapter we show our results on different self-affine IFS. We made assumptions for such self-affine IFS which contains only singular matrices, self-affine IFS with both singualr and regular matrices and in final case when there is exacly one singular and the rest is regular.

Proofs

In this chapter we prove our results separetly. First we show the upper bound for the dimension, then we show the lower bound, which is a little more difficult than the upper bound.

Conclusions

This chapter is a short summary of the results, with some future plans.