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A FURTHER METHOD TO MEASURE FRACTAL DIMENSION AND THE MAXIMUM PROPERTY

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ABSTRACT

The fractal dimension of sets is used in praxis e.g. as a roughness parameter for surfaces, as a texture parameter or for classifying the complexity of line structures. An essential property of fractal dimension is that the most complex-structured part of a set determines the dimension, mathematically described by the maximum property. The most popular methods to measure fractal dimension are the divider stepping method, the sausage method and the box-counting method. Measurements with these methods depend on the range of magnification and on the way the (necessary) linear regression is done. All these methods do not fulfill the maximum property.
A new method based on the box counting theorem is represented here, called extended counting method. It avoids the linear regression, is increasing and even has a quasi maximum property, i.e. the maximum property is fulfilled except of a correction term, which tends to zero if the range of magnification tends to infinity. Several examples are shown demonstrating the method and its properties.

KEY WORDS: box counting method, complexity, fractal dimension, maximum property, self-similar

INTRODUCTION

The fractal dimension of sets appears in many different topics (cf. Mandelbrot, 1977, 1982). Important fields are the theory of nonlinear dynamic sytems or the stochastic growth models of cell systems (cf. Peitgen & Saupe, 1988; Tautu, 1993), where a number of nicely shaped, theoretically defined fractal sets occur. The first concept of fractal dimension was given by Hausdorff (1918). Several other concepts of fractal