FRACTAL GROWTH PATTERNS IN SCIENCE AND TECHNOLOGY

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Fractals and growth patterns have relevance in different areas of science and technology. Fractals are observed in nature, environment, ecology, chemistry, physics, botany, geology, mathematics etc. It is also observed in different parts of human body and several non-living systems. In the present communication, we report basic concepts of Euclidean geometry, fractals and fractal dimension, diffusion limited aggregation (DLA) model, recent advances in fractal growth during electrodeposition of metals and growth of different bacterial colonies.

Introduction

A fractal as first conceived by Mandelbrot[1], is a geometrical structure which at a first look appears to irregular and complex. Fractal is a subject associated with the discipline of non- linear dynamics. It is not limited to science only but even in popular culture, nature and other aggregation processes. Fractals are characterized by dimension which is different from usual Euclidean dimensions having integral values D= 0, D= 1, D= 2 and D= 3 for different geometries as recorded in Table 1.

TABLE 1: Euclidean Dimension for Different Geometries

Geometry	Euclidean dimension
Point (.)	Zero
Line (-)	1
Circle or Square (o, m)	2
Cube ❒	3

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Fractals have non- integer (fractional) dimension D, lying between 1 and 2 or 2 and 3. Various stages in the growth of an exact fractal may be represented by Koch curves. The initial stages of the construction of Koch curves are shown in Fig. 1.

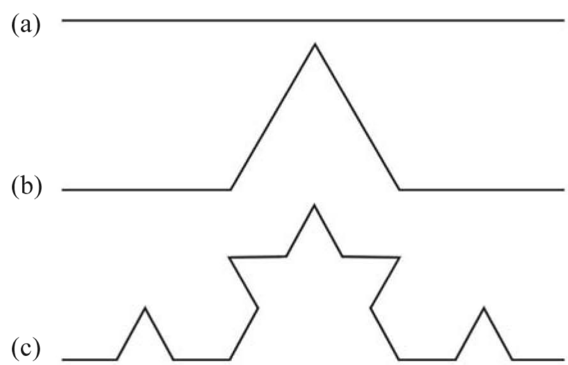

Fig. 1. The first three stages (a)- (c) of the generation of self- similar Koch curve.

The three stages shown in Fig. 1 can be extended an infinite number of times resulting in a curve consisting of infinite number of small segments as shown in Fig. 2.

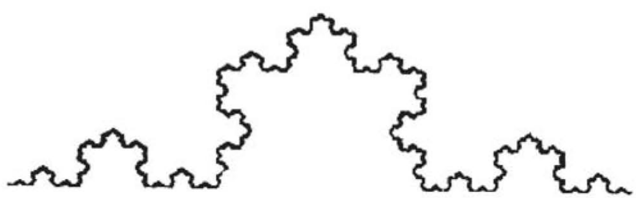

Fig. 2. Koch curve consisting of infinite number of small segments.