Fractals and Chaos Theory: A brief Introduction and Development

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Abstract

Geometry is often considered as cold and dry. One reason lies in its inability to describe the shape of natural objects like cloud, coastline, or a tree. Clouds are not spheres, coastlines are not circles, and bark is not smooth, lightning does not travel in a straight line etc. The existence of these patterns challenges us to study those forms that Euclid leaves for being formless. Generally, people believe that the geometry of nature is centred on the simple figures like lines, circles, polygons, spheres, quadratic surfaces and so on. But there are so many examples in nature which show that the geometry does not depend on simple figures. Can we describe the structures of animals and plants? What is the shape of mountain? Like these structures there are many objects in nature such as cloud, lightening, smoke, coastline etc. which are complicated and irregular.

Moreover, a dynamical system is associated to how the state of a system evolves from one time period to next time period. The dynamical behaviour of dynamical systems is also complicated and irregular. A chaotic dynamical system shows sensitive dependence on initial conditions which means, it is impossible to predict the long term behavior of the system. What is the mathematical model of ups and downs in financial market or even social behaviour? How do we model turbulent weather and cascading waterfall? And many more.....

To analyze many of above questions fractal and mathematical chaos are appropriate tools. Fractals and Chaos are the frontiers of science and play significant role in the study of science, medicine, business, cryptography, textile industries and also in the other areas. This talk is an effort to enlighten some of the ingredients of Fractals and Chaos and their applications. An attempt shall be made to highlight the development phases, brief introduction about Chaos and Fractals followed by my own results.