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REVIEW PAPER ON DIFFERENT SHAPES OF FRACTAL ANTENNA AND ITS APPLICATIONS

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Abstract - *It has been found that designing an antenna using the properties of fractal geometry results in an antenna that resonates at multiple frequencies. Many objects, including antennas, can be designed using the recursive nature of a fractal. In Fractal design is a geometric example that is repeat at each design is to obtain these requirements the fractal antenna is used. The term "fractal" came into the existence in 1975 which means non-regular and never ending pattern. We establish some important types of fractal antenna and the method of considering the fractal geometry in designing various attributes related to the performance of the antenna becomes advantageous when it improves the some parameters such as low VSWR , high gain, wide bandwidth and reduced size etc. Fractal antenna basically centered around two fields: one is the utilizations of fractal antenna and second is the design and investigation of fractal antenna. As of late there has been a lot of enthusiasm for the design of antenna for remote correspondence on account of continuously growing scope of remote telecom benefits and related applications for voice and information transmission.*

***Key Words*: Fractal Antenna, Fractal Geometry, Compact size**

1. INTRODUCTION

The demand of the modern communication system is required antenna with advance features like wider bandwidth, Multi bands, smaller size, high gain and low profile antenna. This has initiated research in various directions, one of which is fractal shaped antenna. In resent year various geometries have been introduced for antenna applications with different dimensions and varying degree of success for improves antenna characteristics. Some geometry designed for reduce antenna size and other for multiband applications such as the Sierpinski Carpet, Sierpinski Gasket, Koch Curve and Minkowski Loop. It can be used to achieve multiple bandwidths and increase bandwidth of each single band due to self similarity in the geometries. The geometry of the fractal antenna encourages its study both as a multiband solution and also as a small antenna.

Properties of Fractal Geometries:

Space Filling Properties: Space filling property is based on space filling curves.

Self Similarity: A self similar object is exactly or approximately same.

2. REVIEW FOR FRACTAL ANTENNA

A large number of fractal antenna design approaches have been proposed for wireless applications. The purpose of the survey is donated to a remarkable growth of antenna design techniques in wireless communications. These reviews have been used to characterize structure in nature that was difficult to demonstrate with Euclidian geometries. These fractal geometries are:

2.1 Sierpinski Carpet

Sierpinski carpet is similar to the Sierpinski Gasket fractal Geometry. We use square shape in place of triangle. The original shape of square without any iteration on simple square patch is known as 0 iteration. The square of dimension identical to one third of original patch is subtracted from the centre of patch to acquire 2nd iteration. This technique is repeated continuously to achieve number of iteration and multiband behavior.

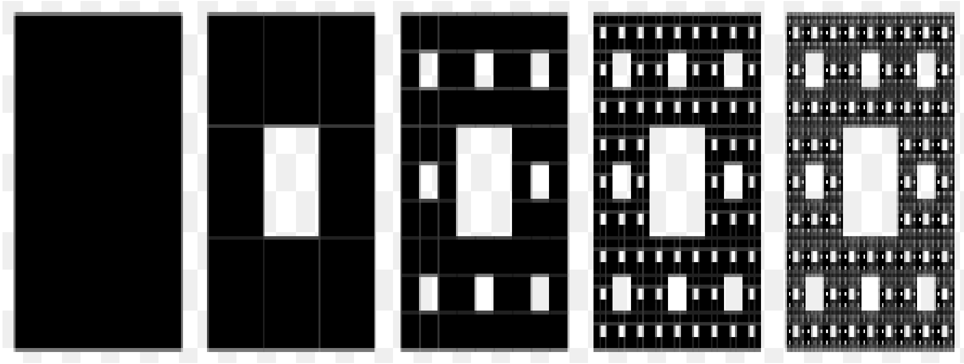

Figure 1: Basic Construction of Sierpinski Carpet Fractal

2.2 Koch Curve

The features of the Koch geometry can overcome some of the limitation of small antennas. The expected benefit of using a fractal as a dipole antenna is to miniaturize the total height of antenna at resonance. This is achieved by using Koch geometry. It does not have piecewise continuous derivative. It is nowhere differentiable. Its shape is highly rough and uneven.

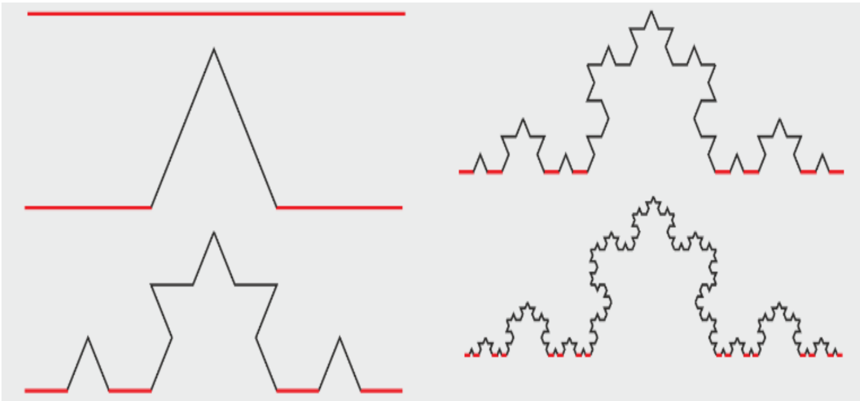

Figure 2: Basic Construction of Koch Curve Fractal

2.3 Sierpinski Gasket

It was discovered by Polish mathematician Waclaw Sierpinski in 1916. The Sierpinski sieve of triangles possesses a certain multiband behavior owing to its self-similar shape as shown in Fig.1.1. A multiband fractal monopole antenna based on the Sierpinski gasket and the Sierpinski triangle has Hausdorff dimension $\log(3)/\log(2) \approx 1.585$, which follows from the fact that it is a union of three copies of itself, each scaled by a factor of 1/2. The area of a Sierpinski triangle is zero. The area remaining after each iteration is clearly 3/4 of the area from the previous iteration, and an infinite number of iterations results in zero.

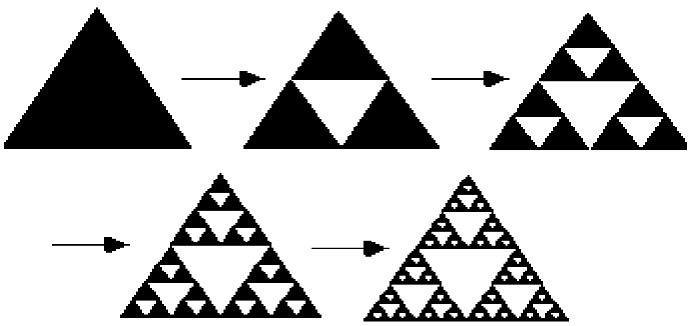

Figure 3: Basic Construction of Sierpinski Gasket Fractal

2.4 Minkowski Loop

It can be used to reduce the size of antenna by increasing the efficiency with which fills up occupied volume with electrical length. It is analyzed where the perimeter is one wavelength. Several iterations are compared with a square loop antenna to illustrate the benefits of using fractal antenna. It is interesting to note that Minkowski fractal antennas are not only broadband, but they also demonstrate multiband effects. This is due to the coupling between the wires. As more contours and iterations of the fractal are added, the coupling becomes more complicated and different segments of the wire resonate at different frequencies.

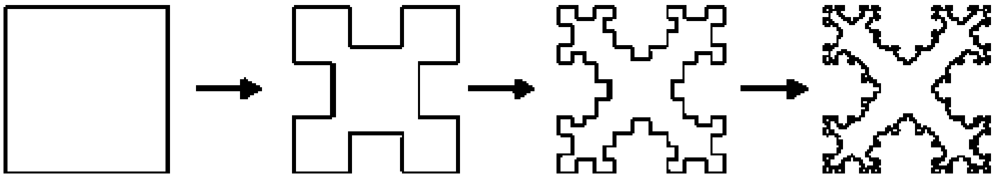

Figure 4: Basic Construction of Minkowski Loop Fractal

3. APPLICATIONS

There are many applications of Fractal Antennas.

In Building Communication: Fractal antenna provides universal wideband antenna technology that is ideal for in – building communication applications. Operating over 150MHz to 6GHz, fractal antennas deliver excellent Omni directional coverage in a compact form factor.

Mobile Devices: From PDAs to cellular phones to mobile computing, today's wireless devices require compact, high performance multiband antennas. At the same time, packaging constraints demand that each component, especially the antenna, be inherently versatile.

Telemetric: Today's automobile can have dozens of antennas that provide everything from emergency notification and navigational services to satellites radio and TV. Multiple antennas create performance and form factor challenges, as well as aesthetic design issues.

RFID (Radio frequency identification): Fractal antenna system provides a compact, low cost solution for multitude of RFID applications. Because fractal antennas are small and versatile, they are ideal for more compact RFID equipment.

4. CONCLUSION

This paper presents the review of various fractal geometries that have been used for different wireless applications. Some of geometries used for reduce antenna size and some are used for multiband purpose. In this paper, we have discussed various design and applications of fractal patch antenna. From this paper we have conclude that specific geometries are used for some specific application and each one have different benefits. And also conclude that sierpinski carpet shape is most widely used fractal geometry because in this shape a single antenna can operate on multiple frequencies.

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