International Journal of Soft Computing and Engineering (IJSCE)
ISSN: 2231-2307, Volume-2, Issue-6, January 2013

Fractal Antenna and Nano Technology Uniforms

Aruna Rani, R. K. Singh

Abstract— This paper presents the latest technology of making a patch antenna using fractals which can be used for making the nano technology uniforms. This Paper is the theoretical analysis and implementation of fractal Antennas.

Index Terms— Fractal Antennas, Nano technology, Koch, Sierpinski.

I. INTRODUCTION

In today world of wireless communications, there has been an increasing need of more compact and portable communications systems. Instead of carrying gadgets or mobile phones in our hand we may patch up or fabricate an antenna in our uniform itself. That may be called as a nano technology uniform[fig. 1]. The person who will wear such uniform will get connected with communication system and we can trace that student or person. We can make such uniforms powerful by introducing the nano cameras(Button size) and speakers. Such uniforms may also be useful for soldiers.

To implement such technology we need to minimize the size of circuit and shape of antenna. As the size of circuitry has evolved to transmitter and receivers on a designed nano chip which is further augmented to evolve antenna to minimize very large scale integration(VLSI) scale size. In present technology various portable system of communication use a very simple monopole with a matching circuit.

However the radiation resistance will decrease, if the multiple pole are quite small with respect to the wave length by which reactive energy increases with inversely proportional radiating efficiency resultantly matching circuit will become less complicated. By the implementation of above technology, size of antenna will decrease without effecting the radiation efficiency. To minimize the antenna size without effecting the radiation efficiency fractal concept can be implemented. Fractals are based on mathematical concept of geometry[1]. The geometrical shape of fractal antennas has a large effective length, can be designed in various forms. These shapes can generate capacitance and inductance, which is useful to match the antenna to the circuit. Because of shape of antenna it can easily printed on a uniform manner. Fractal antennas can be designed in various shapes and size as we require. By the Koch fractals a quarter wavelength monopole can be converted into a similar shorter antenna. This paper focusing on various kind of fractal antennas for uniforms. Which are practically proven efficient.

Manuscript received on January, 2013.
Aruna Rani,Computer Science and Engineering , G.B. Pant Engineering College, Pauri, India.
Dr. R. K. Singh, Uttarakhand Technical University,Dehradun

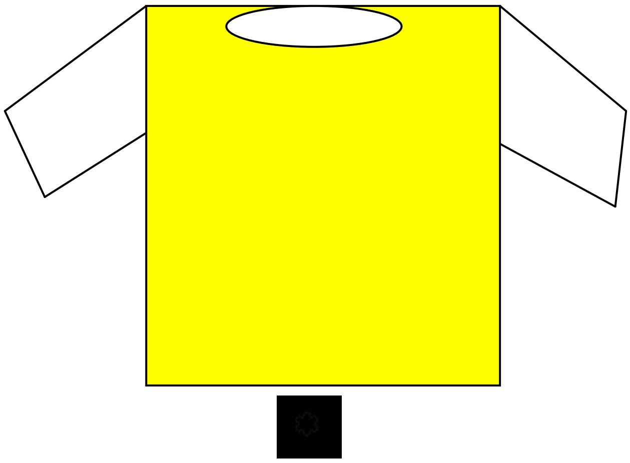

Figure. 1 Nano Technology Uniform with fractal Antenna

II. SIERPINSKI TRIANGLES

In terms of frequency coverage the antenna theory can be divided in three categories as shown in chart below:

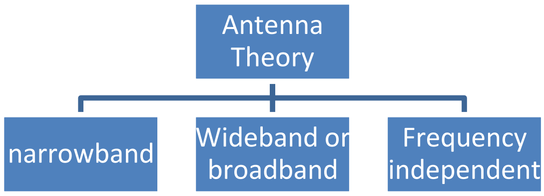

Chart 1 antenna theory categories

a. narrowband covers the small range of the designed operating frequency,
b. wideband or broadband covers greater than narrowband up to octave or two frequency
c. frequency independent covers about a ten to one or greater range of frequencies.

Any good antenna text talks about antenna scaling, that is the properties (impedance, efficiency, pattern, etc.) remain the same if all dimensions and the wavelength are scaled by the same factor. This is to remember that a fractal is a figure that "looks" the same independent of scaling of size, This technology also describes and realizes that a fractal shaped metal element can also be used as an antenna over a very large band of frequency applications. About a ten to one or greater range of independent range of frequency base antennas may be categorized into two parts:

1. spiral antennas and
2. log-periodic antennas".

Nathan Cohen, was the pioneer of fractal antenna who has given the practical theory and analysis with wire fractal antennas (von Koch curves)[2] and fractal planar arrays (Sierpinski triangles)[3].

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

He built the first known fractal antenna in 1988. The geometry of the *fractal antenna* encourages its study both as a multiband solution and also as a small (physical size) antenna[4]. First, because one should expect a selfsimilar antenna (which contains many copies of itself at various scales) to operate in a same manner at various values of wavelengths. As a result, the antenna will maintain same radiation parameters through several bands.

Sierpinski gasket, first described the properties [5] of the triangular shaped fractal antenna (figure 2) and (Figure3).

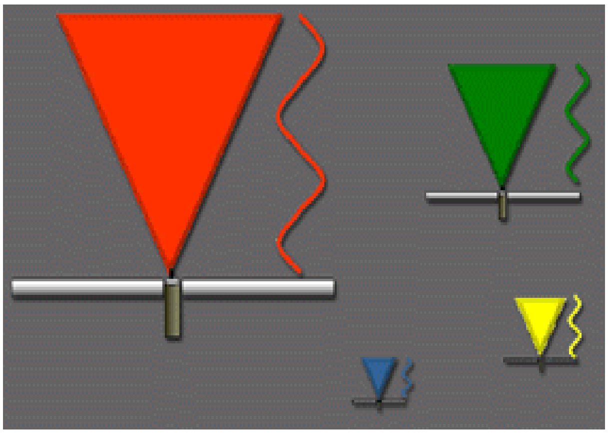

Figure 2 Four separate antennas.

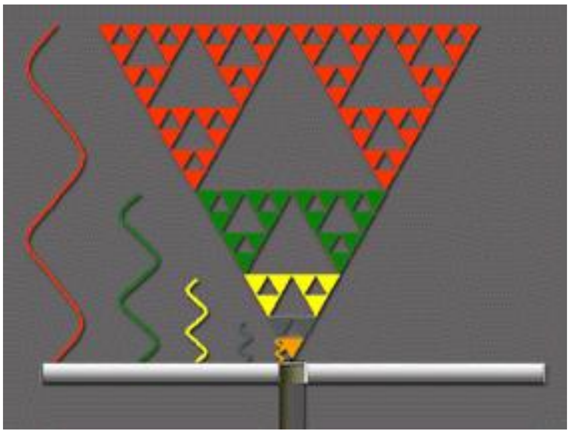

Figure 3 One antenna for four bands.

III. VON KOCH CURVE

In the year 1998 the von Koch monopole reported the first fractal small antenna which improved the features of some classical antennas in respect of resonance frequency, radiation resistance and bandwidth . While such type of antennas has a great demerit that they are bound to fundamental limits on small antennas is still require more theoretical and experimental research for future.

The classical Koch curve construction algorithm is very well known. An Iterative Function System (IFS) algorithm can be applied to generate the succession of curves that converge to the ideal fractal shape.

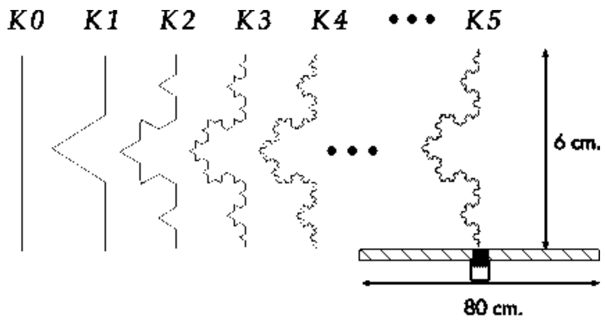

Figure 4 Iterative construction of fractal Koch curve

It has been proven that if we enhance the number of iteration , The Bandwidth and the efficiency gets increased up to some iteration.

Carles Puente (UPC) reported a study of the von Koch fractal as a monopole antenna. The von Koch fractal grows by a factor of an even number, four to odd number three, which gives a similarity in a fractal dimension of approximate 1.26 (log four / log three). The team of Puente studied and analyzed the 6 antennas shown in figure 4.

The team of Puente has analyzed the six antennas by using a MATLAB simulation version of the Moments Method(MOM). In Figure four results shows graphical presentation of the input resistance and reactance for the six antennas. By the figure analysis it seems as the input resistance increases each time the length of antenna also increases each time without changing the size of the antennas. It also seems that the size of the antenna will also remain unchanged. It also observed that, the resonance frequency is shifted towards longer wavelengths becoming resonant antennas even in the small antenna region. A practical and physical observation of such a behavior would be meet out in the increasing number, they can be unbounded, of sharp edges and bends of the fractal multi pole, this will increase radiation.

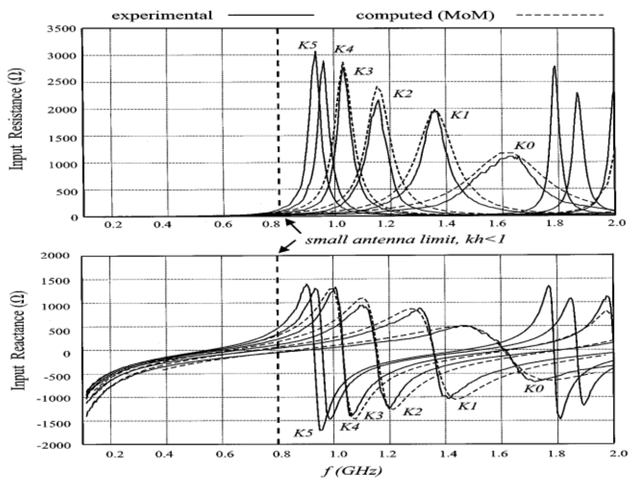

Figure 5 Input impedance of the different fractal Koch monopoles.

By the observation between numerically calculated and simulated data there is good agreement with measurements. It is also pointed out and analyzed, as the number of iterations in the structure increases the resonant frequency decreases[fig.5].

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

IV. VARIOUS DESIGN PATTERNS OF PATCHES FOER NANO UNIFORMS

The figure shows various patterns which can be implemented for making the nano technology uniforms. Rather than the given patterns many other fractals can be generated.

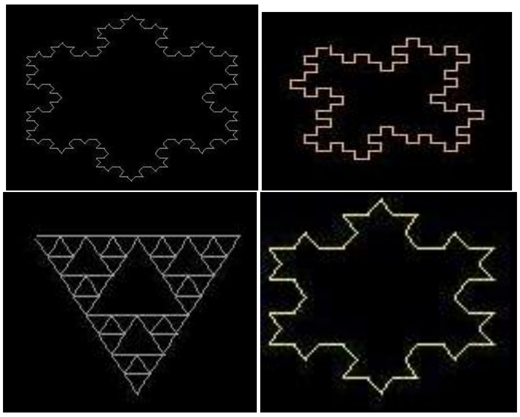

Figure 6 various patterns of factal antennas

V. OTHER APPLICATIONS OF FRACTAL ANTENNAS

There are many other applications that can benefit from fractal antennas. There are several ideas where fractal antennas can make an real impact. As the technology of wireless communication is increasing beyond the expectation , is generating the demand of integrated antennas. The fractal antennas are space saving. These can efficiently fill a limited amount of space by its fractals. The area or size of a shape will remain same by increasing its fractals. These increased fractals will enhance the efficiency of antenna by keeping the size same.

Rather than nano uniforms the fractal antennas have the following applications which are in use currently:

1. Personal hand wireless device (cell phones)
2. wireless mobile devices (laptop)
3. PDAs
4. Dual mode phones
5. weather forecasting device
6. satellite communications
7. defense etc.

VI. CONCLUSION

The analysis shows that the nano technology uniforms may be the great invention and useful for new era. This technology will become the highly required technology. It may be helpful to stop the crimes in the world and to make the system more transparent.

ACKNOWLEDGMENT

I would like to thank Mr. Vinayak Raj dawre and Mr. Raj kumar for their valuable support and encouragement.

REFERENCES

1. C. Puente, J. Romeu, et al: "On the behavior of the Sierpinski multiband antenna," *IEEE Trans. Antennas Propagat.*, vol. 46, pp. 517–524, Apr. 1998.
2. N. Cohen and R. G. Hohfeld: "Fractal loops and the small loop approximation," *Commun. Quart.*, pp. 77–78, Winter 1996.
3. N. Cohen:, "Fractal and shaped dipoles," *Commun. Quart.*, pp. 25–36, Spring 1996.
4. Nemanja POPRŽEN[1], Mićo GAĆANOVIĆ[2]: "FRACTAL ANTENNAS: DESIGN, CHARACTERISTICS AND APPLICATION", regular paper, University of Banjaluka, Patre 5,
5. Carles Puente Baliarda Member, IEEE, Jordi Romeu, Member, IEEE, and Angel Cardama, Member, IEEE: " The Koch Monopole: A Small Fractal Antenna" IEEE TRANSACTIONS ON ANTENNAS AND ROPAGATION, VOL. 48, NO. 11, NOVEMBER 2000.