ISSN No. 0976-5697

Volume 8, No. 4, May 2017 (Special Issue)

International Journal of Advanced Research in Computer Science

REVIEW ARTICLE

Available Online at www.ijarcs.info

Review on different shape Fractal Antenna for Different Applications

[1]Ramandeep Kaur
M.Tech(Scholar)
Department of Electronics & Communication Engg
SBBS University
Punjab, India
kaur.raman322@gmail.com

[2]Er. Hardeep Singh
Assistant Professor
Department of Electronics & Communication Engg
SBBS University
Punjab, India
hardeep.er@gmail.com

***Abstract*- This paper presents the review on two different designed fractal antennas for different applications. All these fractal antennas designed on different substrate and have different parameters such as return loss, VSWR, gain and dielectric constant. This paper compares the performance of these three different types of fractal antenna.**

Keywords- component; formatting; style; styling; insert (key words)

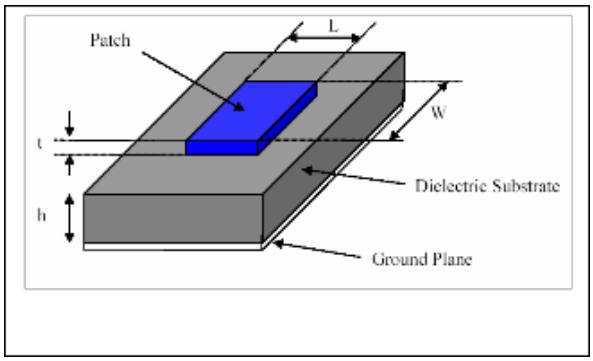
Introduction

Antenna is very important component in wireless communication system. It is a device which converts radio waves into electrical signal and vice versa. The intense growth in wireless communication system and due to increase the demand of portable devices, we need mute-frequency small size antennas. There are various approaches to achieve these features. The fractal antennas were designed to fulfill these demands. The term fractal was originally proposed by mathematician Benoit Mandelbrot to describe a family of complex shapes those posses an inherent self-similarity and space filling. [1] To making the small size and multiband antenna is very critical task. When we reduce the size of antenna, the bandwidth, efficiency and gain are deteriorates of antenna.

Microstrip Antenna

In modern communication system the microstrip patch antenna is a device, which is most widely used than conventional antenna. Due to reason of size of microstrip patch antenna is small as compared to conventional antenna. Other features of microstrip antenna are low cost, simple structure and compatible with integrated circuit. The patch on the microstrip antenna can be of any shape such as rectangular, triangular, square etc. and it made of conducting material. At antenna the patch made at one side and ground plane is mad at other side of antenna. [2]

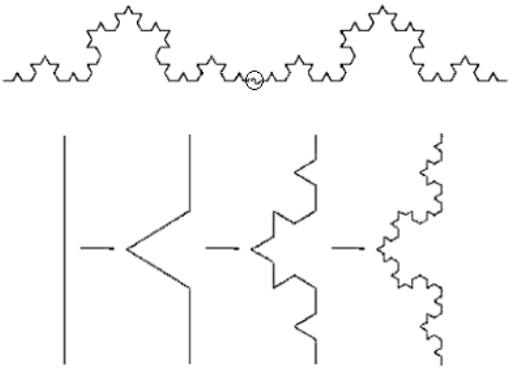
By slot loading on the patch, we can achieve compact circular polarized antenna. The load of slot excited of current path on patch surface and this lower the antenna resonant frequency. Size and operating frequency of microstrip patch antenna are related to each other, as the size of antenna reduces the operating frequency of antenna increased and vice versa. [3] The microstrip antenna is a one or two frequency band and narrow band antenna; it is a major problem of this antenna. Because of this problem fractal antenna re designed, which are multi frequency and wide band antenna.



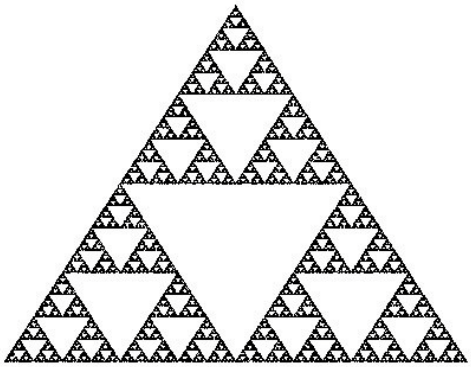
Fractal Antenna

Fractal antenna a multiband and wide band antenna, which repeat the base shape of antenna again and again. It means it is based on iterative method. Fractal geometry modifies the structure of conventional antenna, to improve the performance or parameters of antenna. The fractal antenna overcomes the problems of microstrip antenna like less and small frequency band. Fractal geometry has two main properties such as self similarity and space filling, which are used to improve the performance. Self similarity means repeat itself after each iteration. [4] Self similarity concept can achieve multiple frequency bands because at different scale different parts of antenna are similar to each other.

CONFERENCE PAPERS
National Conference on Emerging Trends on Engineering & Technology (ETET-2017)
On 21st April 2017
University Inst. of Engg. & Tech. & University Inst. of Computer, SBBS University, Punjab (India)



Koch fractal antenna



Sierpinski fractal antenna

In other words the fractal is a fragmented geometry shape which can be divided into part, each of which is reduced size copy of whole. There are various fractal geometries such as sierpinski carpet, minkowski, Koch curve cantor set etc. which are used to miniaturize the size of antenna and for multiband feature.

Directivity is defined as Ratio of maximum radiation intensity of subject antenna to radiation intensity of reference antenna. In other words directivity is defined as ratio of radiation intensity in a given direction to radiation intensity averaged over all direction. [3] An antenna radiation is defined as graphical representation of the radiation property of antenna.VSWR is calculate as Voltage standing wave ratio is defined as ratio of maximum voltage to minimum voltage. Gain of antenna takes the directivity of antenna into account with its effective performance. Efficiency of antenna is defined as ratio of radiated power of antenna to input power accepted by antenna.

Different fractal design methodology

The first design is stair cased shaped fractal antenna for wireless applications. The antenna is designed with substrate FR4 glass epoxy substrate with parameters like. The thickness of substrate is 1.6mm, dielectric constant is 4.4. The resonant frequency is 3.8GHz. The maximum gain observed is 7.15db.The rectangular patch of this fractal antenna design is of length 80mm and breadth 60 minds the ground plane is of length 100 mm and breadth 90 mm.

In this design to analyze the performance coaxial feed is used and three iterations are used to achieve better performance. In 0^{th} iteration the antenna resonate at eight different frequencies and respective return losses. The 1^{st} iteration is designed to minimize the effective area of proposed antenna and enhance resonance of designed antenna. The 2^{nd} iteration work at five different frequencies.

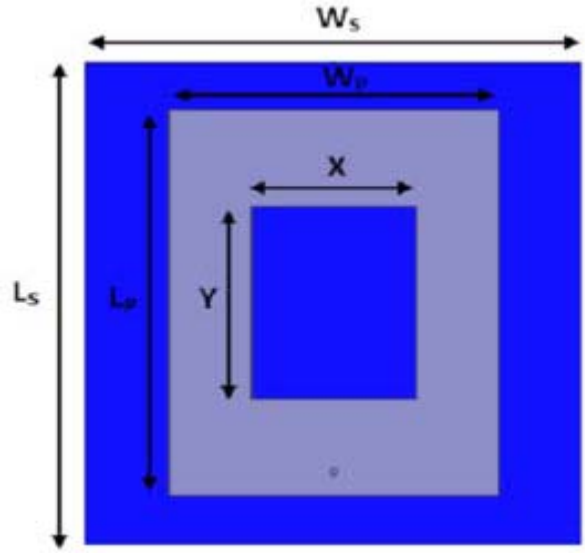


Fig.1. Stair cased antenna-zero iteration

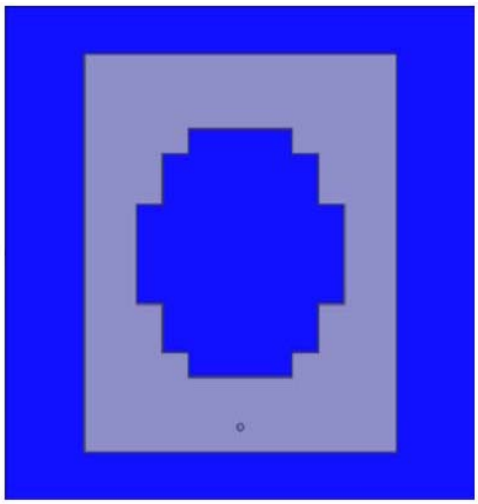


Fig.2. Stair cased antenna-first iteration

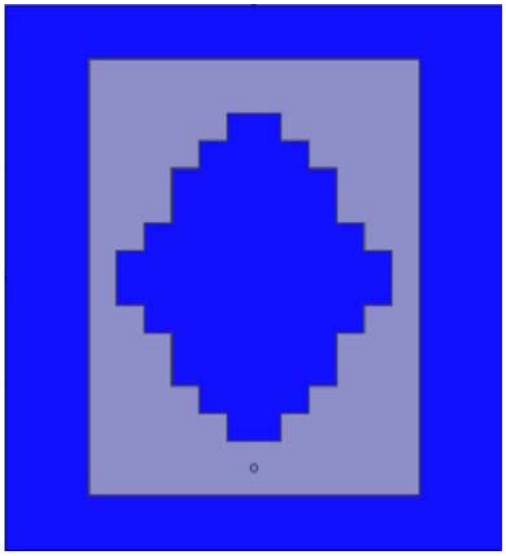


Fig.3. Stair cased antenna- second iteration

In this design to analyze the performance coaxial feed is used and three iterations are used to achieve better performance. In 0^{th} iteration the antenna resonate at eight different frequencies and respective return losses. The 1^{st} iteration is designed to minimize the effective area of proposed antenna and enhance resonance of designed antenna. The 2^{nd} iteration work at five different frequencies. The proposed antenna perform better over S-band (2.67-2.87GHz), WiMAX (4.5-4.6GHz and 5.2-5.5GHz), C-band (6.95-7.4GHz) and X-band (8.6-8.65GHz) application. [5]

The second design is U- slot antenna compacted with Koch fractal with electromagnetic band gap. The electromagnetic band gap is designed at ground plane. This design of fractal antenna uses Roger RT/Duriod 5880. The ground plane of this antenna is filled with electronic band gap and u slot with Koch curve fractal antenna is printed on upper side of antenna. The parameters of antenna are given as dielectric constant of materiel is 2.2 thickness of material is 0.38mm. This antenna design was reduce the size of antenna with bandwidth of 70 MHz the return loss and VSWR respectively were -22.38db and 1.165 of this designed antenna.

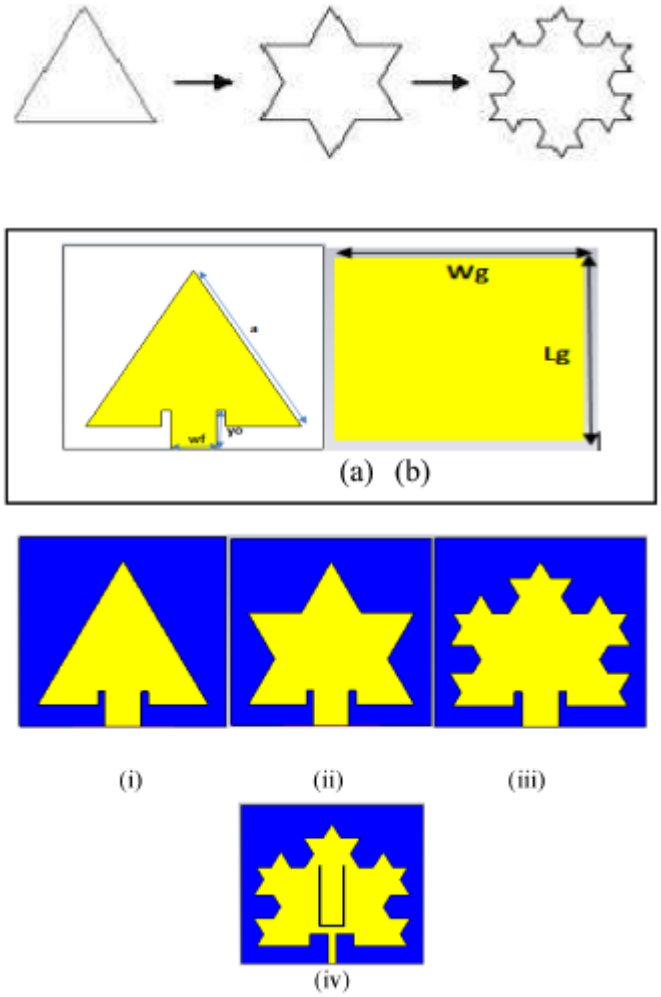


Figure 4

The size of proposed antenna was 28*26*0.38 mm. The return loss of conventional patch antenna is -22.81 db at resonant frequency 5.8 GHz and return loss of fractal antenna with U-slot and EBG at ground plane is -33.34 db. The VSWR of U-slot fractal with EBG is 1.028 which was lower than congenital fractal antenna VSWR 1.156. At the ground structure the bandwidth of U- slot fractal antenna with EBG is 130.5 MHz it show that this antenna increasing the bandwidth and it also increased the gain and directivity[6]

Antenna Parameters Comparison

To compare the performance of these two antennas we need to study the parameters of these antennas and conclude that which one is better. Both antenna use different dialectic substrate, the first antenna use FR4 glass epoxy substrate and the second antenna use RT/Duroid 5880.The return loss of the U-slot compacted antenna is -22.38 and the stair cased shaped fractal antenna has five different resonant frequencies and their respective return loss but the highest return loss is -27.35db. The thickness of u slot antenna and stair cased antenna respectively are 0.38 mm and 1.6 mm. the dielectric constant are 2.2 and 4.4. So the stair cased shaped fractal antenna is better than U-slot fractal antenna.

Parameters	Stair Cased shaped fractal Antenna	U-Slot antenna compacted with Koch fractal antenna
Return loss	-27.35db	-22.81db
Gain	6.38db	7.51db
VSWR	1.165	1.028
Thickness	1.6mm	0.38mm
Dielectric Constant	4.4mm	2.2mm
Dielectric Substrate	Roger RT/Duroid 5880	FR4 glass epoxy substrate

Conclusion

This paper presents the comparison of two different designs fractal antenna. Study the result of both paper and from upper discussion I conclude that the stair cased shape fractal antenna is perform better, because its return loss of this antenna is better than U- slot antenna. The other parameters are also better such as VSWR, gain. The stair cased shaped antenna used in wireless applications such as S- band, C-band, WiMAX etc. and the U- slot antenna is used especially for RFID at 5.8 GHz.

Future Development

These antennas can be further improved by changing the parameters such as improving the return loss, gain, VSWR and using different fractal pattern and by using different values of substrate.

REFERENCES

[1] B.B Mandelbrot, "The Fractal Geometry of Nature, New York," W.H. Freema, 1983.

[2] Sonal Mishra, Prof. Prateek Wankhade," Review On Microstrip Patch Antenna For Wireless Applications," International journal of latest trend in engineering and technology (IJLTET). Vol. 5 Issue 4 July 2015.

[3] Gurpreet kaur, Er. Sonia Goyal," A Review Microstrip Patch Antenna Design," ISOR Journal of Electronic and Communication Engineering (ISOR-JECE). Special Issue-AETMIS

[4] Amanpreet Kaur, Gursimranjit Singh,"A Review Paper on Fractal Antenna Engineering," International Journal of Advance Research in Electrical, Electronic and Instrument Engineering and Computer Science. Volume- 3 Issue- 9 September, 2014 page no. 8270-8275.

[5] Ghriti Khana, Narinder Sharma," A Novel Design of Stair Cased Shaped Fractal Antenna for Wireless Applications," 2016 2nd International Conference on Next Generation Computing Technology (NGCT-2016).

[6] K. Ismail and A.S. Hashemi. Rosli," U-Slot Antenna Compacted With Koch Fractal with Electromagnetic Band Gap," 2016 International Conference on Radar, Antenna, Microwave, Electronic and Telecommunication

CONFERENCE PAPERS
National Conference on Emerging Trends on Engineering & Technology (ETET-2017)
On 21st April 2017
University Inst. of Engg. & Tech. & University Inst. of Computer, SBBS University, Punjab (India)