Reconfigurable Sierpenski Triangle Fractal Antenna Research and Development

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ABSTRACT

This paper proposes a frequency-configurable (Sierpenski Triangle) fractal antenna. The antenna design is modeled and simulated using HFSS software, and the frequency reconfigurability is achieved by adding a PIN diode. The antenna S1C3 with a frequency of $f = 11.57GHz$ adapts best to the 1st structure, while the antenna S2C5 with a frequency of $f = 4.9GHz$ adapts best to the 2nd structure.

Keywords: Frequency Reconfigurable Antenna, Sierpenski Triangle, PIN diodes

1 Introduction

To meet the current needs of the telecommunications industry, the designers created an important feature: the ability to be permanently connected to a network. Weight, volume, cost, ease of manufacture, and, most importantly, the ability to be installed on any type of electronic device are all advantages of these antennas. This type of antenna, however, has limitations such as narrow bandwidth and low gain.

Reconfigurable antennas can solve these issues by dynamically changing their properties such as the frequency, the radiation pattern, the polarization, or a combination of these three parameters. The advantages of reconfigurable antennas include their compact size, the effective use of the electromagnetic spectrum, and a similar radiation pattern and gain across all desired frequency bands [1].

2 Related works

There are several methods for reconfiguring antennas. Some techniques use active localized components to modify quasi-punctual current lines or impedance [2]. Li *et al.* [3] propose a new frequency-reconfigurable antenna (FRA) comprised of quasi-sierpinski fractal dipoles integrated with a dual-band high-impedance surface (HIS). Kumar *et al.* [4] proposed a frequency reconfigurable multiband high gain cascaded sierpinski gasket fractal antenna (CSGFA).

3 Simulation and Results

We investigate the properties of a sierpinski fractal before designing frequency-reconfigurable fractal antennas. Figure 1 shows the antenna's structure and its dimensions.

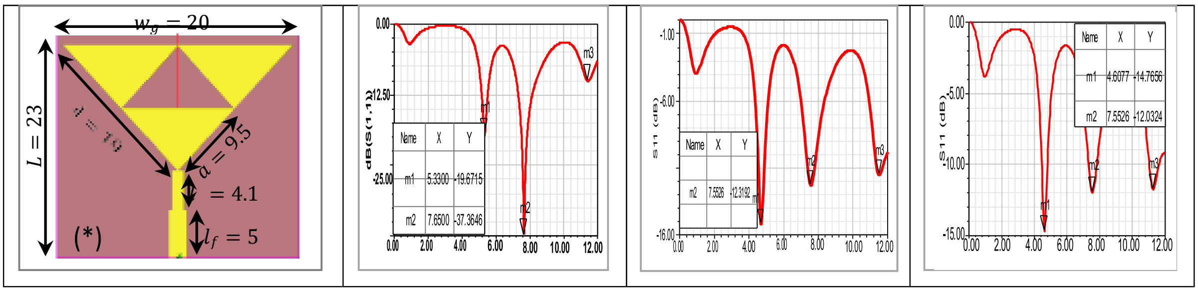

Figure 1: *Sierpinski triangle fractal antenna's structure, dimensions (mm) and results*

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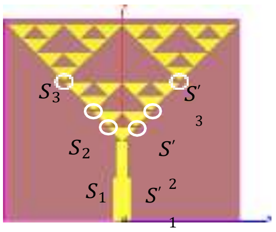
3.1 Sierpinski fractal antenna

Figure 1 depicts the three structures and S_{11} parameter of the sierpinski fractal antenna. This result indicates that this structure is well suited to the frequencies of $7.65G$, $4.73\ GHz$ and 4.61GHz, respectively for the 0th order, 1st order and 2nd order fractal antenna.

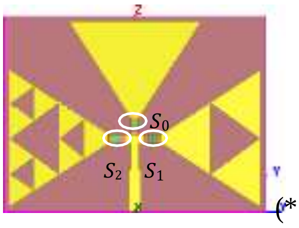
3.2 Reconfigurable sierpinski fractal antenna

We modified the sierpinski fractal antenna for the design of a reconfigurable fractal antenna by inserting PIN diodes inside the structure. We proposed and tested two structures (Figure 2).



(*)

Configurations	S1C1	S1C2	S1C3	S1C4
S1	1	1	1	0
S2	1	1	0	0
S3	1	0	0	0



(**)

Configurations	S2C1	S2C2	S2C3	S2C4	S2C5
S1	1	1	0	0	1
S2	1	0	1	0	0
S3	1	0	0	1	1

Figure 2: *Reconfigurable fractal antenna (*) 1st structure (**) 2nd structure.*

Figure 3 depicts the S_{11} parameter for the various configurations of the 1st (*) and the 2nd structure (**). The results show that the proposed antenna can be reconfigured in frequency. In addition, the antenna S1C3 with a frequency of $f = 11.58GHz$ provides the best adaptation for the 1st antenna. Furthermore, we notice that the S2C5 antenna with a frequency of $f = 4.9GHz$ provides the best adaptation for the 2nd antenna.

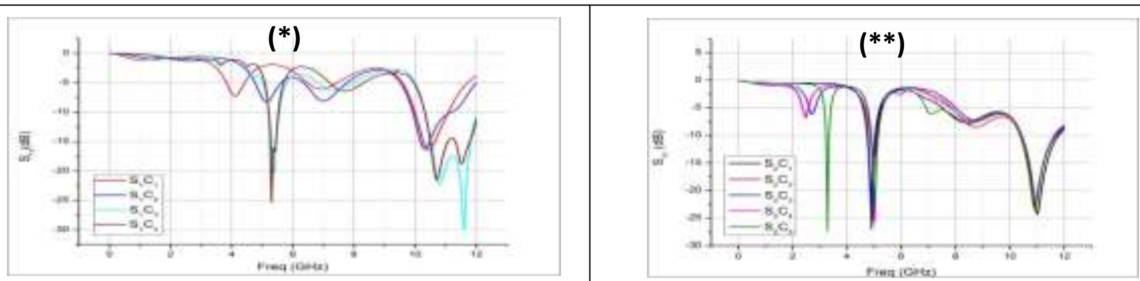


Figure 3: *S11 parameter of the configurations for the (*) 1st structure and (**) 2nd structure.*

4 Conclusion

In this paper, we proposed a frequency-reconfigurable fractal antenna based on sierpinski triangle. The parametric analysis of this antenna, including the parameter S11, was carried out using the HFSS simulator. Using different diode states, we investigated two structures. As a result, these structures can be reconfigured in frequency based on the S_{11} coefficient. The antenna S_1C_3 with a frequency of $f = 11.58GHz$ provides the best adaptation, it may be used for x-band applications. Whereas the antenna S_2C_5 with a frequency of $f = 4.9GHz$ provides the best adaptation, this frequency is suitable for wireless LAN applications.

How to Cite

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