International Journal of Advance Research, IJOAR .org
Volume 1, Issue 3, March 2013, Online: ISSN 2320-9199

PAPER PRESENTATION ON ANTENNA AND WAVE PROPAGATION COMPARISON OF FRACTAL ANTENNA AND YAGI-UDA ANTENNA

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Abstract-

A fractal antenna is an antenna that uses a fractal, self-similar design to maximize the length, or radiation within a given total surface area or volume.

The Yagi consists of one driven element, plus one or more shorter elements acting as directors placed in front of it, plus one or more longer elements acting as reflectors placed behind it.

Keywords:

frequency band, resonances, frequencies.

1. INTRODUCTION

With the improving researches in the field of communication, various types of antennas were developed in course of time. Here is another one in the classification- Fractal antennas. As the name implies, this antenna uses a fractal to maximize the length of the material that transmits or receives electromagnetic radiation or to increase the perimeter of the transmitting or receiving material at a given volume or total surface area, they are referred to as space filling curves also. But the secret or key lies in the iteration or the repetition of one motif over multiple scale sizes.

The fractal antennas are wideband antennas or multiband antennas. They are now widely used in cellular applications and communications using microwave. If we are to search for an example of fractal antennas, the space filling curve in the form of a shrunken fractal helix should serve the purpose. In this curve, each line of copper represents a small fraction of wavelength.

In yagi-uda antennas the Log Periodic array consists of a uniformly tapered array of many elements. The lengths of the elements and the spacing between them decrease by a constant ratio as you move down the array, and all of the elements are electrically connected to the feed line. The objective is an array that's very broad in frequency. The idea is that at any given frequency within the total range of the array, the element closest to a resonant length will radiate/receive best, those in front of it will function as directors, and those behind it will function as reflectors.

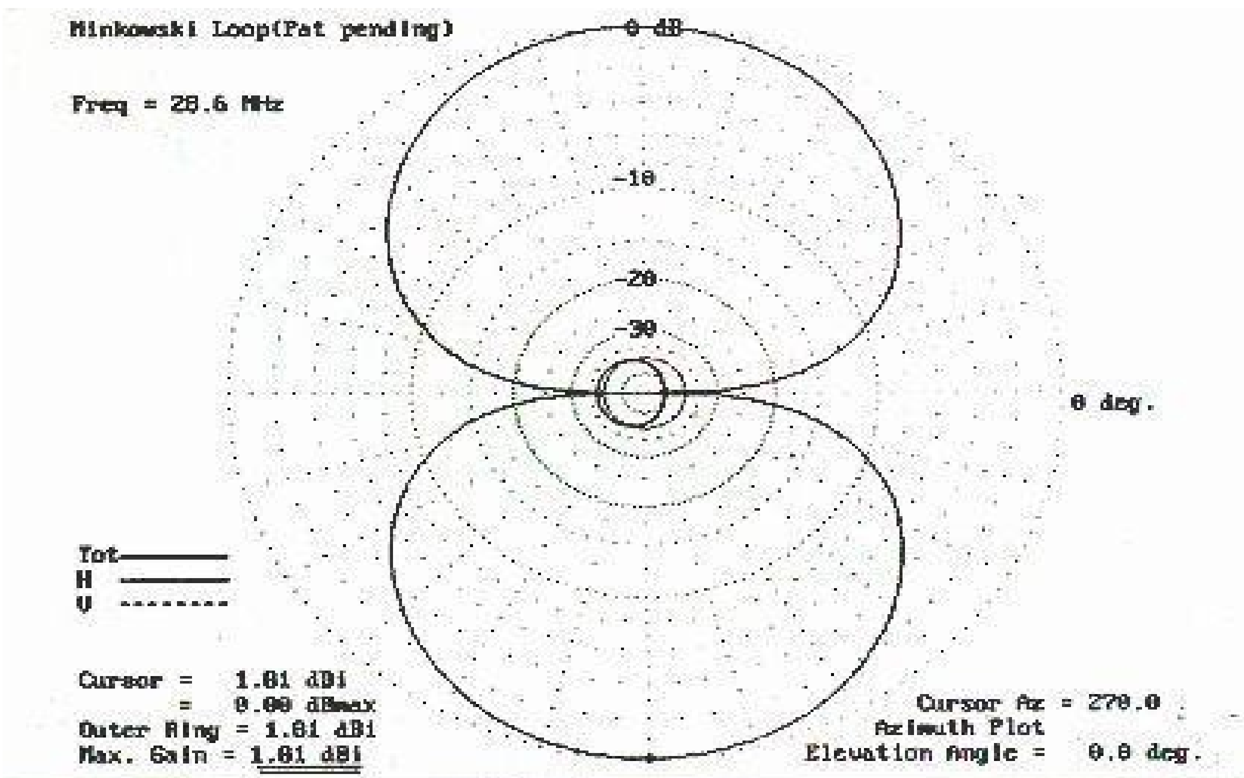
2. FRACTAL ANTENNA AND PERFOMANCE

Many fractal element antennas use the fractal structure as a virtual combination of capacitors and inductors. This makes the antenna so that it has many different resonances which can be chosen and adjusted by choosing the proper fractal design. Electrical resonances may not be directly related to a particular scale size of the fractal antenna structure. The physical size of the antenna is unrelated to its resonant or broadband performance. The general rule of antenna length being near target frequency wavelength does not apply itself in the same way with fractal antennas.

This complexity arises because the current on the structure has a complex arrangement caused by the inductance and self capacitance. In general, although their effective electrical length is longer, the fractal element antennas are themselves physically smaller.

Fractal element antennas are shrunken compared to conventional designs, and do not need additional components. In general the fractal dimension of a fractal antenna is a poor predictor of its performance and application. Not all fractal antennas work well for a given application or set of applications. omputer search methods and antenna simulations are commonly used to identify which fractal antenna designs best meet the need of the application.C

A fractal antenna is capable of providing god or excellent performance at a wide range of frequencies at the same time. This came out as a greater advantage of fractal antenna over the traditional antennas and was considered as its remarkable advancement or difference over the latter.



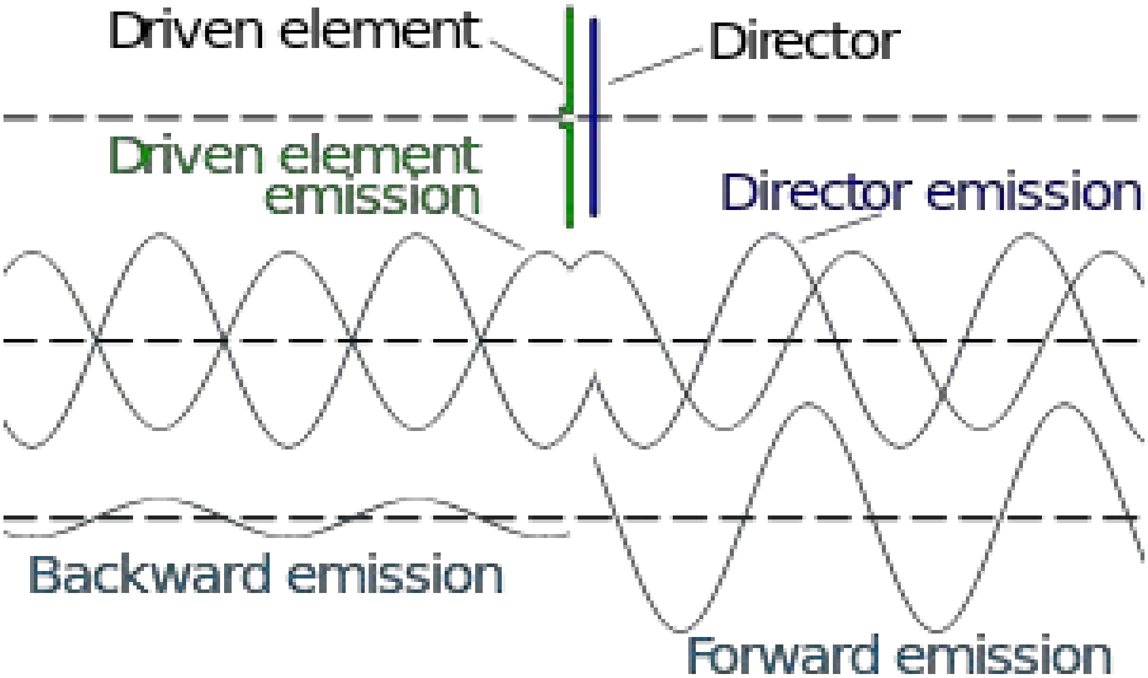
The free-space gain pattern for this fractal loop gives dipole-like coverage with negligible losses compared to a dipole.

3. YAGI-UDA ANTENNA AND PERFOMANCE

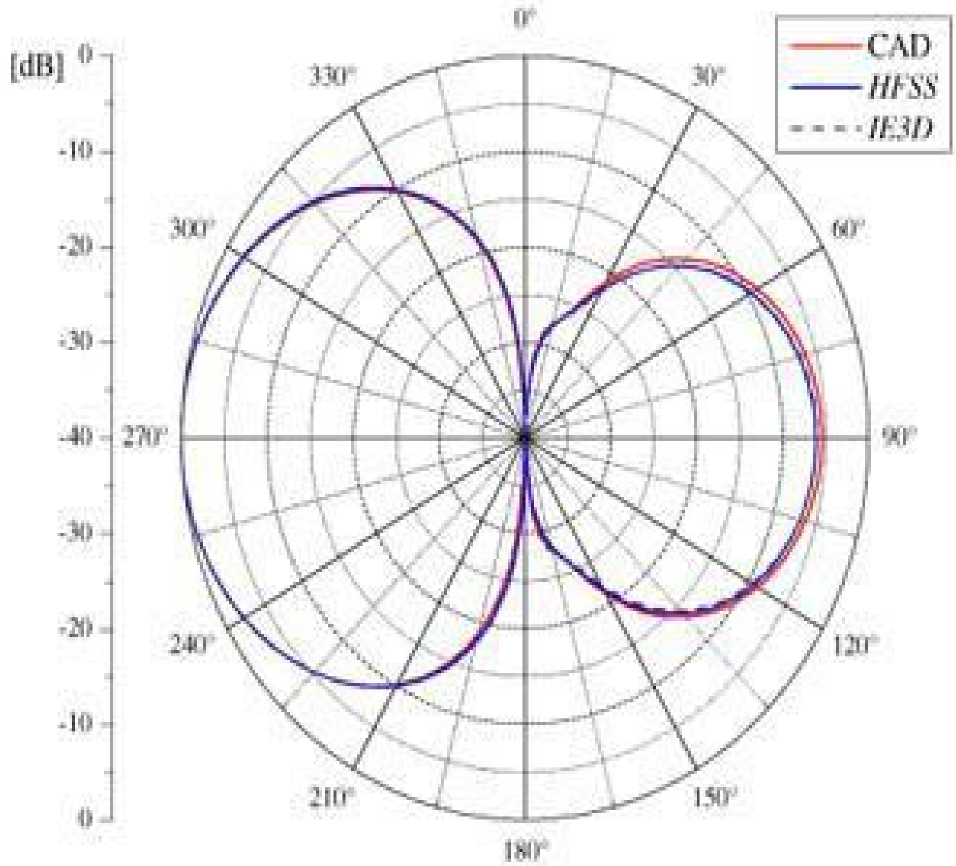
The driven element in yagi uda antenna is typically a λ/2 dipole or folded dipole and is the only member of the structure that is directly excited (electrically connected to the feed line). All the other elements are considered *parasitic*. That is, they reradiate power which they receive from the driven element.

The operation of such an antenna is to consider a parasitic element to be a normal dipole element with a gap at its center, the feed point. Now instead of attaching the antenna to a load (such as a receiver) we connect it to a short circuit, a short circuit reflects all of the incident power 180 degrees out of phase. So one could as well model the operation of the parasitic element as the superposition of a dipole element receiving power and sending it down a transmission line to a matched load, and a transmitter sending the same amount of power down the transmission line back toward the antenna element. If the wave from the transmitter were 180 degrees out of phase with the received wave at that point, it would be equivalent to just shorting out that dipole at the feed point .

The *director* element, on the other hand, being shorter than λ/2 has a capacitive reactance with the voltage phase lagging that of the current. If the parasitic elements were broken in the center and driven with the same voltage applied to the center element, then such a phase difference in the currents would implement an end-fire phased array, enhancing the radiation in one direction and decreasing it in the opposite direction. Thus one can appreciate the mechanism by which parasitic elements of unequal length can lead to a unidirectional radiation pattern.



4. RADIATION PATTERN OF YAGI –UDA ANTENNA



Yagi-Uda antenna radiation pattern

5. ANALOGY BETWEEN SIMPLE ANTENNA AND FRACTAL ANTENNA

If we compare fractal antennas to the conventional ones it can be said that the former is a little shrunken and does not require having additional components. But we cannot use any fractal antenna for an application because of the reason that not all the fractal antennas give their 100% performance for every set of application or some specific application. The specific fractal antenna for the given application should be chosen or selected.

The commonly used antennas are designed to work well at a particular frequency and they are said to perform excellently at that single frequency. As variations occur in the frequency, the performance also gets reduced. This is another reason for the wide range acceptance of the fractal antennas for multiband as well as wideband applications.

6. APPLICATION OF YAGI UDA ANTENNA AND FRACTAL ANTENNA

A Yagi-Uda antenna is familiar as the commonest kind of terrestrial TV antenna to be found on the rooftops of houses. It is usually used at frequencies between about 30MHz and 3GHz, or a wavelength range of 10 meters to 10 cm. (There are some obsessional amateur radio enthusiasts who construct Yagi-Uda antennas for the 80 meter wavelength band. This is rather impractical as spacing them from the ground by more than half a wavelength is difficult.) The rod lengths in a Yagi-Uda are about a half wavelength each, and the spacing's of the elements are about 1/3 of a wavelength. This puts the overall sizes of Yagi-Udas in the ranges .

Fractals are not only used as antennas but also find application in rest of the antenna system components. These components include ground planes, loads and counterpoises. Along with fractal element antennas, the other areas of use were also discovered.

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