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A Review on Challenges and Technology for Evolvatory Antennas using HFSS and GA

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Abstract - Optimizing the geometry for desired radiation characteristics is an important aspect in the design of electromagnetic systems like micro devices. There are several conventional techniques that are used for efficient optimizations of these electromagnetic systems. However, they are less efficient when compared with the other evolutionary techniques. In this paper, a brief review of techniques involved in integrating the electromagnetic modelling tool with evolutionary computing tools is discussed. A brief review on the efficient design of the antennas and other electromagnetic systems, using this integration tool is discussed with the aim of with perspective of several results and reports generate to analyze electromagnetic system.

Keywords **—Broad band, Multiband, Notch band, Microstrip, GA, HFSS**

I. INTRODUCTION

Optimization [1] is a process of miniaturization. Optimization requires design characteristics of antenna parameters such as physical dimension & pattern. Here we can optimize length, breadth, height of a substrate material called miniaturization [2]. Optimization can be done soon after designing of antenna and some conventional tools are used and evolutionary algorithms like GA, PSO[3], will be used for effective antenna optimization used for e.g., GA & HFSS is used for design of an antenna. So, here in this paper we design an antenna by optimizing the required length, breadth and other physical dimensions of the antenna in order to produce the desired radiation characteristics for various applications [4][5][6]. We can use conventional tools like HFSS or CST for Electromagnetic simulation tools. In CAD Environment almost GUI realistic tools will be used for antenna design for [7][8][9]. Design Phenomena will be controlled, then evolutionary computing-controlled antenna design and Optimization will be done.

II. DESIGN PROBLEM

A. Wide band antennas

The increased demand for small and multi-functional wireless system has developmental changes in the frequencies. Demand for these types of small, miniaturized devices is increasing day.

Micro strip patches are widely used in such cases. These are used for compactness, low profile, less weight and most effective. But patch antennas are limited by operating frequencies. There are several methods for changing dimensions of and antenna which includes increase of the thickness of the substrate. For impedance matching, low dielectric substrates are used. Feeding techniques also playing vital role in the used of slot antenna geometry. In general, there are several properties which conflict in antenna are design out of them, bandwidth and size are more important

B. Multiband antennas

These days as communication has increased, band of frequencies should also be increased. This is because of the demand of wireless service requirements. When an antenna is designed to serve the above the dimensions of an antenna should match with the wireless device. The dimensions of wireless devices are small hence antenna should also be designed with smaller dimensions, and more than one operating system frequency required while maintaining the performance. Due to these the demand for the multiband antenna is increasing as it requires more frequency bands. In modern antenna design wideband and multiband are in demand because of their rapid increasing attention in the latest trend. These are used in the modern wireless technology. In these devices roaming capability and down ward capability among multi standards are demanded. In this modern tread the antenna which is used in having a demand for small compatible and affordable dimensions and the above mentioned antennas must be multiband due to increased frequency requirements. As we know that most antennas are operating at high frequencies. These antennas are dependent on wavelength. By changing wave length of the antenna performance characteristics can

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be changed. Modern technological systems require design features such as low weight, low profile, single feed antenna and multiband. Among all these unique features multiband featured antennas are commonly used. These high-profile features are interacting with RF modules for other frequencies to make a single antenna. In this scenario, narrow band width is the most disadvantages and one of the serious problems of micro strip patch antenna

C. Notch antenna:

In the area of communication mostly in recent trends micro strip antennas are useful because of their growth which serves the purpose. They also good in dimensions, which can be optimized coherently. Apart from these multiband antennas there is a great need for designing broad band antennas. In cased wide band antennas frequency range is increased but the unwanted frequencies will be included in the band. This limitation is avoided in the broad band antenna where frequency band can be increased drastically and also unwanted frequencies can be eliminated. Hence UWB antennas got the demand in the industry with single, dual and triple band notched properties with miniaturization. These are having the properties of compact size, simple design, low cost, thin profile, light weight planar configuration and easy fabrication. Among all for high end applications micro strip patch antenna is suitable. Here as the antenna design is complex, UWB antennas require careful monitoring compared with the micro strip patch antenna for practical applications careful study is required and manufacturing should be done carefully. Without changing physical parameters, distortion can be reduced up to great extent. By changing the bandwidth distortional will be reduced without changing the physical parameters. Fractals are used for this purpose. Along with above mentioned antennas notch is also serving the purpose of compactness. It is a low profile, low weight, low cost antenna By reducing the bandwidth distortion will be reduced without changing the physical parameters fractals are used for this purpose Along with these antennas a notch antenna is also serving the purpose of compactness. It is a low profile ,low weight ,Low cost antenna.Patch antenna is also used with microwave IC. The advantage can be designed and soon their parameters can be optimized using GA and HFSS.

III. Simulation Tools Used

A. Advantages of Combined GA & HFSS

MATLAB which in associated with GA & VB script of HFSS are combinedly used. GA is the best technique for solving complex problems. HFSS is an attractive software tool for analyzing the behavior of EM practical Different antenna models can be designed and optimized by combining the GA & HFSS. Both the techniques of GA and HFSS are combinedly used for several antenna optimizations.

i. Advantages of HFSS

High frequency simulation software (HFSS) is an interactive tool which includes commands that are used for analyzing the electromagnetic behavior in detail. Using HFSS we are able to build quantities that are related to basic electromagnetic fields.

ii. Advantages of GA

On the other hand, genetic algorithm is a search algorithm which entirely depends on natural genetics. In order to serve fruitful optimization GA is a best method as it combines evolutionary solution that combines random bits of information and structural exchange of information. This GA algorithm is said to be robostic method. Since there will be no restrictions on the solutions that are obtained during the processing. There with the help of history means of past data, we can predict the improvement performance of the data for future purposes.

As we are having plenty of advantages and advancements with HFSS & GA, we can make use these together to obtained the better result for high frequency solutions, particularly for complex models.

B. Challenges in GA

Although, GA is a best suitable modern technique for optimization, it produces time consuming simulation for hundreds of times. Hence, to improve optimization efficiency the time consumption to be reduced. To achieve it GA can be combined with the other algorithms (TSA) . We can enhance the performance optimization by the combination of GA with other algorithms.

IV. Conclusion

Optimization is a process of miniaturization. Optimizing the geometry for desired radiation characteristics is an important in the design of electromagnetic devices. In this Paper, Optimization of antenna can be carried using GA & HFSS. Conventional Optimizing techniques are compared with modern techniques such as GA & HFSS and proved to be serving better

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