Design and Analysis of H-cut Slot Antenna Using BBO Algorithm

Kamal Jain[1], Sukhdeep Kaur[2]

[1]*Student at JCDM College of engineering, Sirsa, Haryana, India*
[2]*Associate Professor in ECE Department at JCDM College of engineering, Sirsa, Haryana, India*

Abstract- In this paper a microstrip rectangular H-cut slot antenna is designed and results are optimised by biogeography based algorithm. FR4-epoxy is used as a substrate having thickness of 1.6mm and dielectric constant is 4.4.In this return losses are calculated and then optimised by biogeography based algorithm. In this effect of different material of substrate has been studied. The resonating frequency of this antenna geometry 4.9 Ghz, 7.3Ghz and 9.3 Ghz. This H-cut slotted antenna works for WLAN, Satellite and Radar applications.

Keywords- *Biogeography Based Optimization, Microstrip, satellite.*

I.   INTRODUCTION

Microstrip Antenna play an important role in modern wireless applications, such as radio, TV, mobile and satellite [1]. They are useful in high power transmission, reduced power consumption and enhanced spectral efficiency. The synthesis of microstrip antenna with desired pattern has been a subject of very much interest in the literature. Several well-known evolutionary optimization techniques; such as Biogeography based optimisation, particle swarm optimization (PSO), Taguchi optimization, genetic algorithm (GA), and differential evolution (DE); have been used in the synthesis of microstrip antenna [2-9]. Biogeography-Based Optimization (BBO) is a biology inspired optimization technique developed by Dan Simon in 2008 and is inspired by mathematical models of biogeography by Robert MacArthur and Edward Wilson. Biogeography based optimization (BBO) technique is a new global evolutionary multi-dimensional optimization method. It is based on the science of biogeography which is the nature's way of species distribution. The mathematical model of BBO is based on the extinction and migration of species between neighbouring habitats which is any island that is geographically isolated from other islands. Islands that are more suitable for habitation than others are said to have a high habitat suitability index (HSI). HSI is considered as a dependent variable. Another interesting variable is called suitability index variable (SIV) which characterizes habitability. It is an independent variable of the habitat. BBO has already proven itself as a valuable optimization technique compared to other already developed techniques [10-13]. BBO adopts migration operator to share information between solutions like GA and PSO. BBO is applied to the sensor selection problem for aircraft engine health estimation and for general benchmark functions. The Markov analysis, on simple uni-modal, multimodal and deceptive benchmark functions with low mutation rates prove that BBO outperforms on GA. BBO is a new global optimization algorithm and has shown its ability to solve optimization problem.

II.   ANTENNA GEOMETRY

In this antenna design, a microstrip rectangular H-cut antenna is made on FR4-epoxy substrate. Microstrip feed line is used to excite antenna. The dimensions of the patch is 40×30 mm. Design of simple patch antenna shown in fig.1.
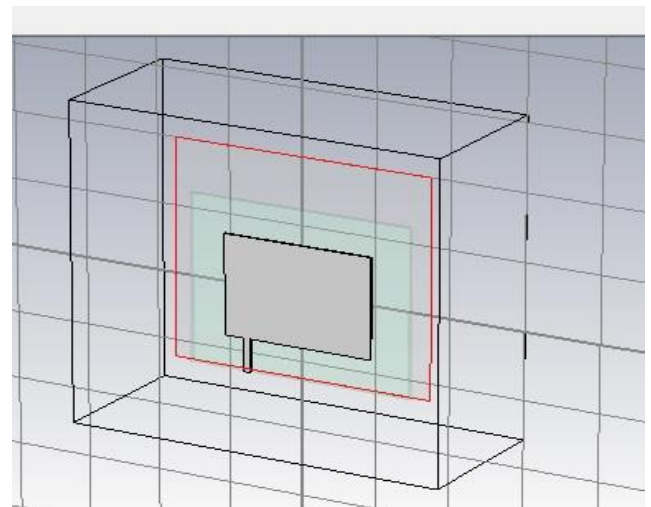

Fig.1: Design of basic patch antenna

In the basic patch antenna design H slot is cut. By cutting H-slot in the patch area of the patch will be reduced and s parameters will also be improved-cut slot antenna is shown in fig.2.
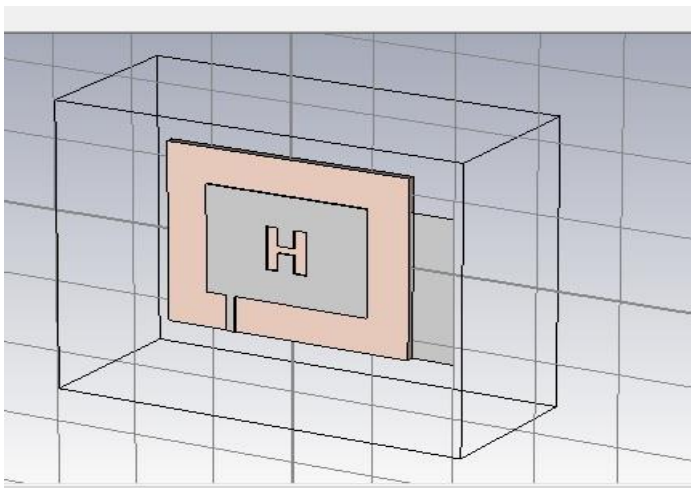
Fig.2 Microstrip Rectangular H-cut Antenna.

III.   SIMULATION AND RESULTS

A. Return Loss of h-cut slot antenna and BBO algorithm

Return loss-In this paper return loss of proposed antenna has been studied and analysing results using CST and BBO algorithm. In this the return losses is more in the frequency range 7 to 8 ghz and S-parameter is about -45 db. And two another bands are at 4.9 and 9.3 ghz and their S- parameters are -17 and -37 respectively. In the fig.3 return loss of H-cut antenna has been shown. In this, results are optimized using BBO algorithm and in this compare the results that are obtained from CST and BBO.Fig.4 shows s parameter obtained from BBO. In this studied that at 7.4 Ghz, results of CST and BBO has been matched.
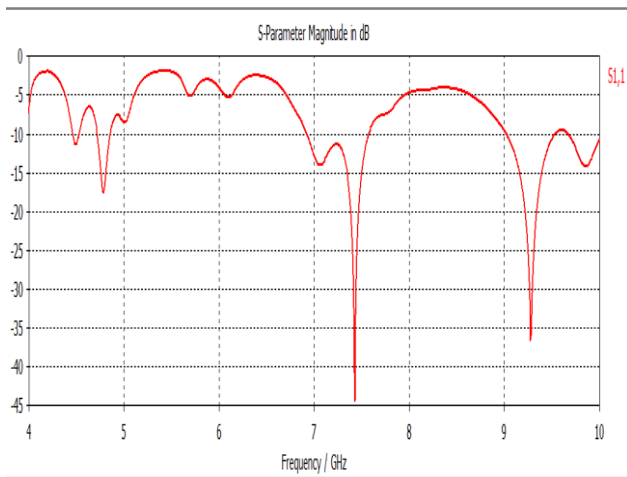

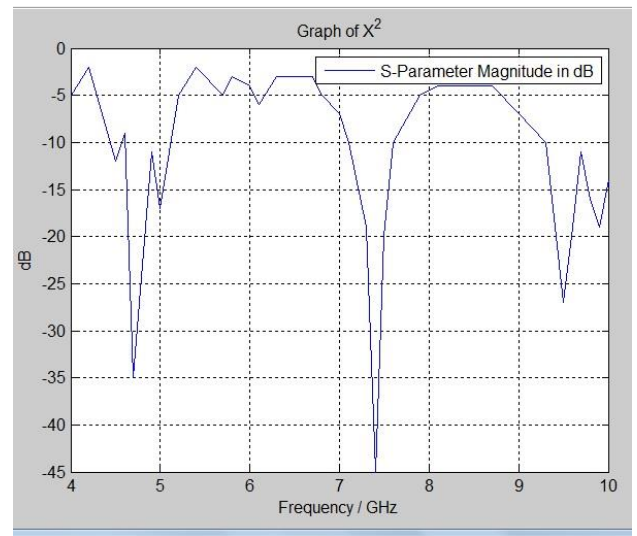Fig.3 S Parameter of H-cut slot antenna

Fig.4 Output of BBO algorithm

B. Effect of different material on the return loss

In fig.5 and fig.6 return loss of different material have been studied. From the results concluded that the FR4-Epoxy shows better results than Rogger and aluminium nitride.
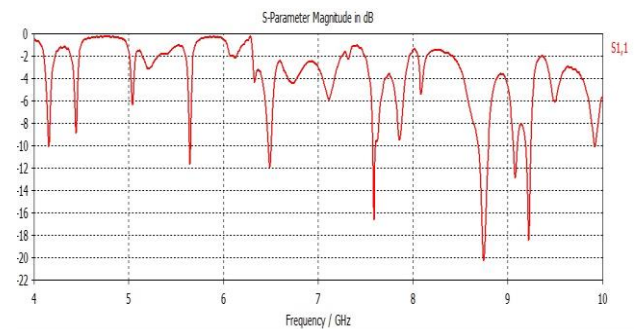

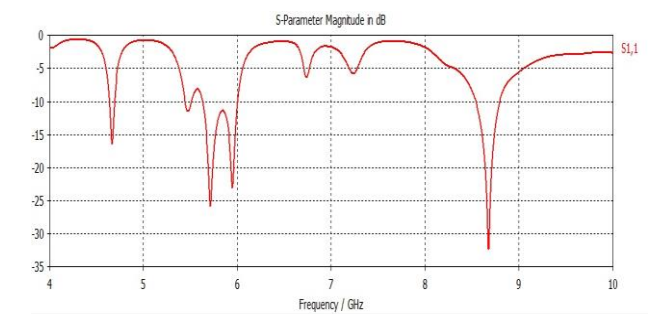Fig.5 Return loss by using substrate aluminium nitride

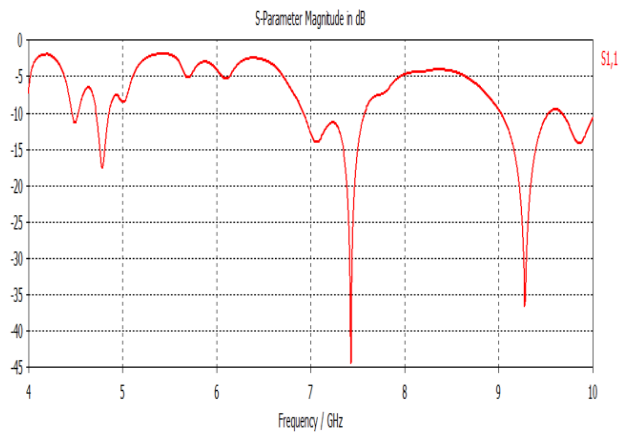Fig.6 Return losses by using substrate Roger

Fig.7 Return losses by using substrate FR4-Epoxy

IV. CONCLUSION

In this, a microstrip H-cut antenna has been studied. In this results obtained from CST and BBO has been compared and concluded that at 7.4 Ghz frequency results are matched and at 4.9 Ghz and 9.3 Ghz results show large deviation. In this results of different substrate material have been compared and found that FR4-Epoxy has better results. This antenna works for WLAN, satellite and radar applications.

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