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Deaf Antenna for Mm Wave Filter Using HFSS

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ABSTRACT: *Inspired by the success of supervised bagging and boosting algorithms, we propose non-adaptive and adaptive re-sampling schemes for the integration of multiple independent and dependent clustering. We investigate the effectiveness of bagging techniques, comparing the efficacy of sampling with and without replacement, in conjunction with several consensus algorithms. In our adaptive approach, individual partitions in the ensemble are sequentially generated by clustering specially selected subsamples of the given data set. The sampling probability for each data point dynamically depends on the consistency of its previous assignments in the ensemble. New subsamples are then drawn to increasingly focus on the problematic regions of the input feature space. The comparison of adaptive and non-adaptive approaches is a new avenue for research, and this study helps to pave the way for the useful application of distributed data mining methods.*

Keywords: *High-Frequency Structure Simulator (HFSS), Dual Element Adaptive Frequency Antenna (DEAF), 5G Applications.*

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I. INTRODUCTION

1.1 Introduction

In the field of wireless technology, there is a need to enhance the performance of wireless devices in the area of voice and data communication. In modern world, wireless devices are compact in size and useful for many applications. The microstrip patch antenna offers a low profile i.e. thin and easy manufacturability which provides great advantage. With this fast-growing development in antenna engineering Microstrip Patch Antennas are keeping a vital role in application of mobile radio, wireless communication, high-performance aircraft, satellite, missile and spacecraft because of their light weight, low profile, simplicity and low cost. Rectangular, circular, elliptical these are some common patch shapes that have a good demand and fame for their feed line feed line flexibility and multiple frequency operation. There are several methods available in literature to feed or transmit electromagnetic energy to a microstrip patch antenna. The most famous techniques are the microstrip transmission line, coaxial probe feed, aperture coupling and proximity coupling. The antenna is one of the critical components in any wireless communication system. A microstrip patch antenna (MPA) consists of a conducting patch of any planar or non-planar geometric on one side of the dielectric substrate with a ground plane present on other side. Feeding can be done by using any one of the methods such as co-axial feed, line feed, inset feed, proximity coupling or aperture coupling. Some advantages of the microstrip antennas are its small size which is because of substrate size, low profile, and that it is light weight.

II. EXPERIMENTAL SETUP

2.1 Antenna Design

A patch-antenna is a metallic area suspended above a ground plane. They are simpler to construct, modify and adaptive. These are built on a de-electric insulator or substrate, similar to an IC fabrication process.

A micro-strip antenna has a patch called as radiating patch and a dielectric substrate having the ground plane on the other side. The strip uses a $\lambda/2$ length patch with a bigger ground plane for good performance at the cost of size. The ground plane is moderately large when compared to that of the patch. The flow of current is in the feed direction. Such the electric field E and vector potential follows the current. Antenna radiates linearly polarized wave. The radiations are shaped due to slots that radiates both on the top and the bottom, which results in the current flow.

The proposed design is shown in Fig. 1. The antenna elements are evolved from a simple rectangular patch antenna. The proposed antenna uses Flexible Rogers 4350B laminate as a substrate. The dielectric constant of the substrate is 3.36 and the thickness of the substrate is 0.8 mm. The proposed antenna has a compact size of 11.4 mm x 6 mm. The antenna is fed by a 50 Ω micro strip line.

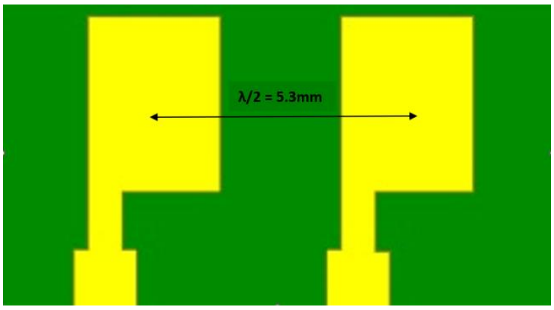

Fig 1: Layout of Hybrid Fractal Antenna

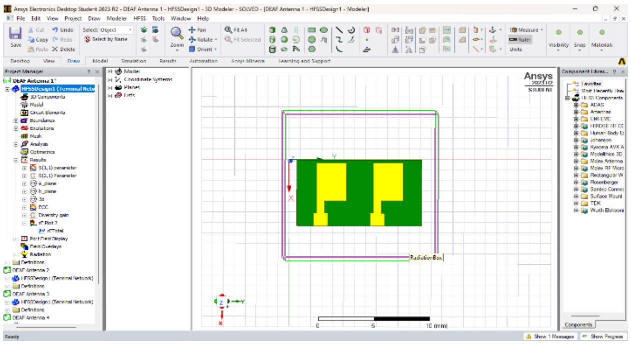

Fig 2: DEAF Antenna using HFSS

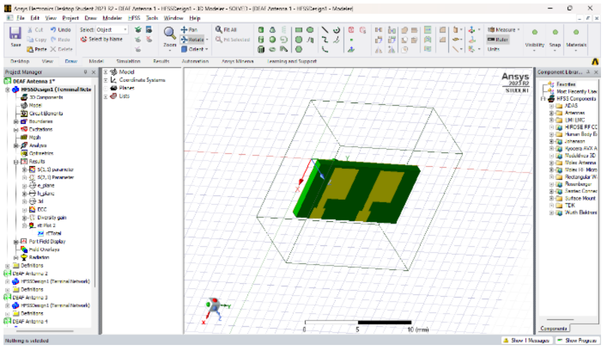

Fig2: DEAF Antenna using HFSS

2.2 Antenna Parameters:

Analysis of various parameters like Effective Length, Effective Width, and Effective Dielectric constant

Width of the patch:

$$W = \frac{c}{2f_0\sqrt{\frac{(\varepsilon_r+1)}{2}}}$$

Length of the patch:

$$L = L_{eff} - 2\Delta L$$

Where

W-width of the patch

C -velocity of light (3x10^11mm)

L-length of the patch

ε_r - dielectric constant of substrate

Effective length is given by:

$$L_{eff} = \frac{C}{2f_{0\sqrt{\varepsilon_{eff}}}}$$

Normalized extension in length is given by:

$$\frac{\Delta L}{h} = 0.412\frac{(\varepsilon_{reff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{reff}-0.258)\left(\frac{W}{h}+0.8\right)}$$

Effective Dielectric Constant:

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2\sqrt{1 + \frac{12h}{w}}}$$

The design parameters of the DEAF Antenna is tabulated

Table1: Design Parameters of DEAF Antenna

Parameters	Dimensions
Length of the substrate	11.4mm
Width of the substrate	6 mm
Height of the substrate	0.8 mm

III. RESULTS AND DISCUSSION

3.1 By using the Ansoft High-Frequency Structure Simulator of version 14, each and every simulation are performed and observed.

RETURN LOSS :

The S parameter S11 represents the return loss of a device. The return loss in an antenna gives power loss in the signal when returned which is caused due to load mismatch with transmission line impedance. The return loss value should be less than 10 dB. Figure 3 shows the return loss S11 of introduced antenna design.

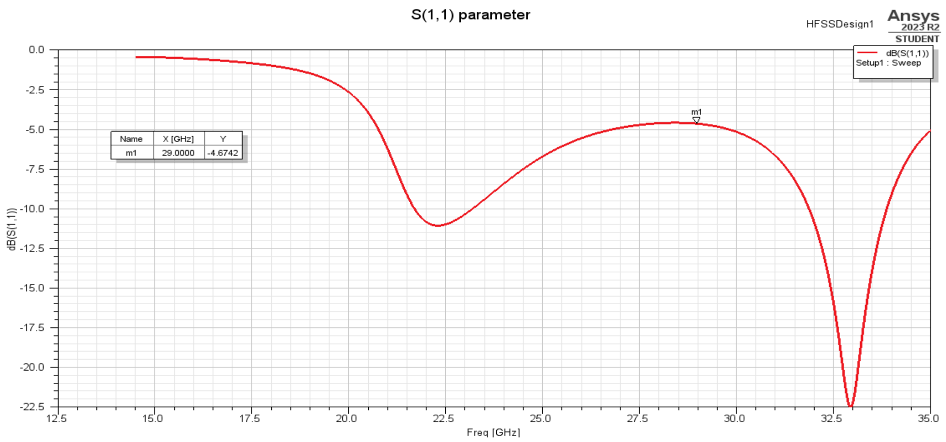

Fig 4: Return Loss Plot of DEAF Antenna

VSWR :

Voltage standing wave ratio represents how well the device matches between source impedance and terminal impedance. Figure 4 shows the VSWR Plot of the DEAF Antenna.

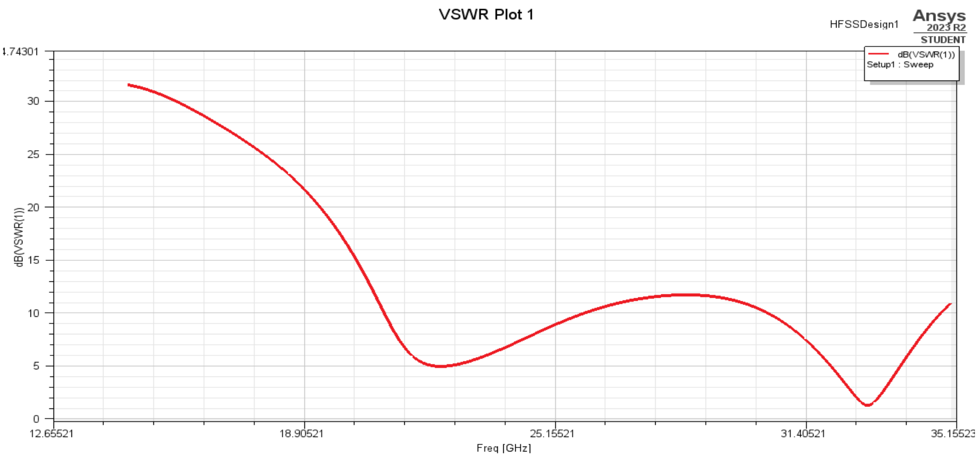

Fig 5: VSWR Plot of DEAF Antenna

GAIN:

Antenna gain tells us the power transmitted by antenna is a specific direction. It describes how strong a signal an antenna can send out or received is a specified direction. Figure 6 shows the gain plot of DEAF Antenna.

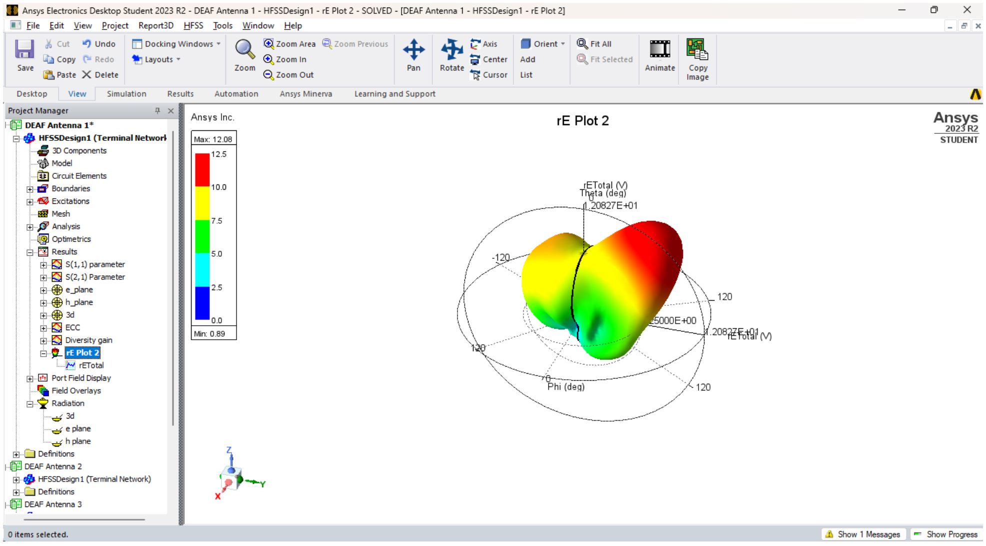

Fig 6: Gain plot of DEAF Antenna at 29 GHz

RADIATION PATTERN:

A radiation pattern defines the variation of power radiated by an antenna as a function of the direction away from the antenna. The radiation pattern at phi=00 , 900 is represented in figure 6 and figure 7 for the frequency of 29GHz.

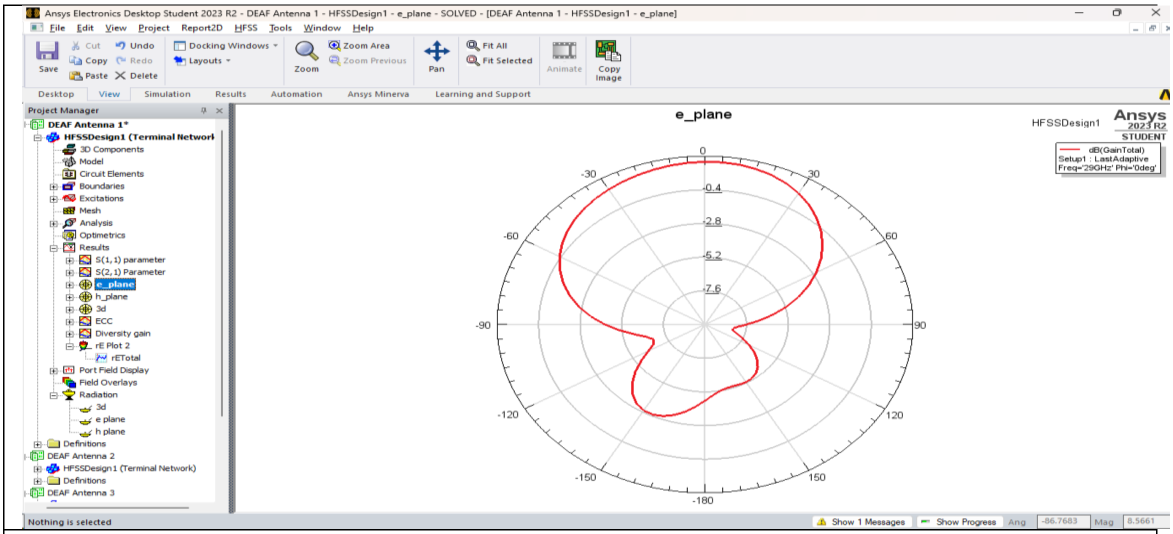

Fig 7: Radiation Pattern of DEAF Antenna at 29 GHz for E-plane

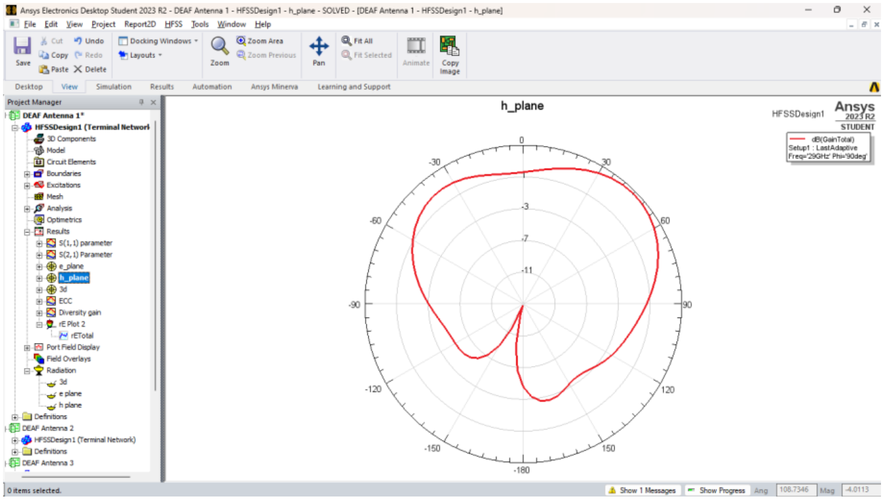

Fig 8: Radiation Pattern of DEAF Antenna at 29 GHz for H-plane

Envelope Correlation Coefficient (ECC):
ECC is a measure of the correlation between the radiation patterns of MIMO receiving antenna pairs where it tells us how independent does the two antennas radiation patterns are. The lower ECC offers the best performance for the antenna designed. Its value ranges from 0 to 1, where 0 represents no correlation and 1 is complete correlation of the radiation patterns. Figure 5 shows the ECC plot of DEAF Antenna.

DIVERSITY GAIN:
Diversity gain is the increase in signal-to-interference ratio or how much the transmission power can be reduced when a diversity scheme is introduced, without a performance loss.

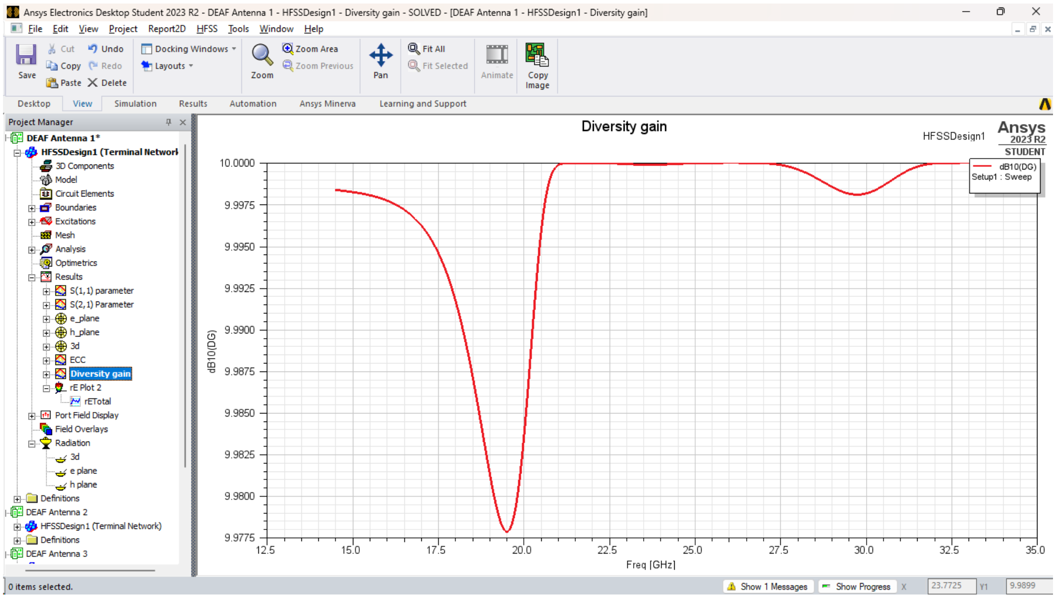

Fig 9: Diversity Gain of DEAF Antenna

IV. CONCLUSION

4.1 Concluding remarks

DEAF Antenna for Wireless Applications with a size of 11.4*6.3mm^2 has been designed with a line fees technique. The feeding technique is implemented to give excitation to the antenna and the results are obtained. The fractals play a very important role to reduce the antenna size and make a best effective gain. DEAF antenna has ability to design for frequency of 29GHz. The simulation is carried out using HFSS software. The designed antenna has improved performance characteristics, and the designed antenna is useful for Wireless communication applications

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