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# Analysis of Elliptical and Circular Patch Antennas In Presence of HIS

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*Abstract*— **As the HIS Surfaces exhibits different properties mainly its constructive and distructive propertie on radiation pattern is very much useful in enhancing are supressing the radiation. This paper mainly shows how the eliptical and circular patch antenna are radiating in presence of the HIS. This paper illustrates the general parameters of both antennas by placing a HIS surface along one side of the regular antenna. And Return loss, input imedance, Radiation patterns, Gain and some other antenna parameters foe both antennas are illustrated in this paper. And both were designed under same circumstances.**

***Index Terms*** **— Energy band gap, Enhancement of energy, high impedance, surface wave suppression.**

## I. Introduction

A "high impedance surface" is an artificial material/structure formed by periodic metallic arrays printed on a metal-backed substrate , which exhibits extremely high impedance (ZHIS >> Zfree space) in one or several frequency ranges. And it mainly surpresses the propagation of surface waves. And when radiation form antenna is incidenting on this structure it either absorbs or reflects the radiation energy and enchances the antenna parameters which is explained in [1]. In this paper a elliptical patch antenna and a circular patch antenna are designed and the simulated results are presented. And the figure [1] shows the structre view of HIS.

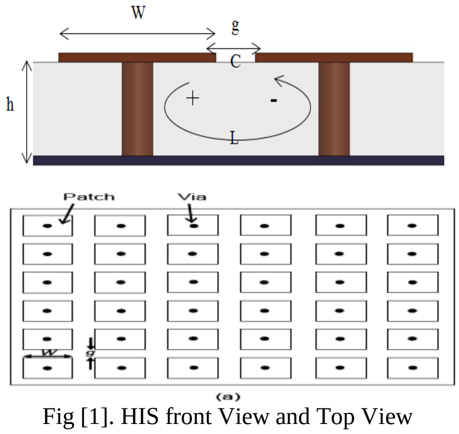


Fig [1]. HIS front View and Top View

Here in the HIS the gap between plates exhibits capacitance and the pillar hight for having Inductance.

## II.Design of Antennas

Here an Elliptical patch antenna of major radius 4cm and ratio 30 and circular patch antenna of radius 2.3cm are placed on substrate of same thick ness and dimensions and same material and both are analyzed in the presence of same antenna. and they are shown in below figure [2].

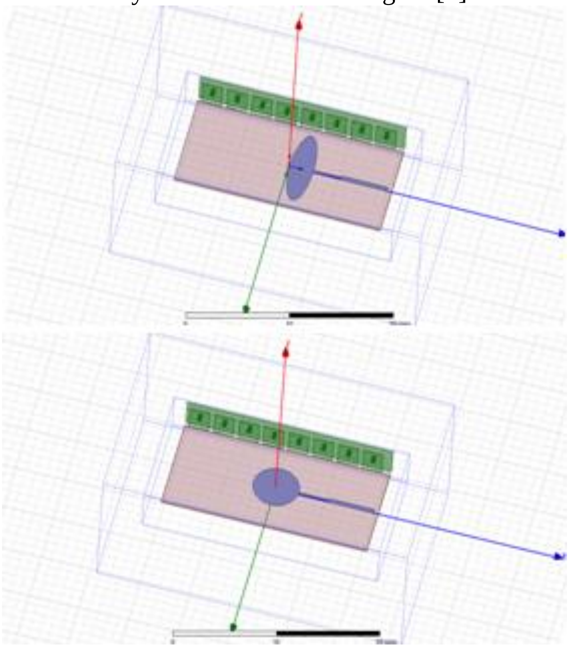

Fig [2]. Elliptical and Circular patch antenna Design in HFSS software

## III.HIS Design

HIS designed by taking plate size of 2×2cm and pillar of hight 0.5cm and radius 0.2cm.
And the HIS parameters are calculated by the following Equations shown below.
$\varepsilon = (2\varepsilon V/\pi)(\cosh^{-1}[(w+g)/g])$.

).

Capacitance
$C= W\varepsilon_o(1+\varepsilon_r) \cosh^{-1}((2W+g)/g)/\pi$
Inductance
$L=\mu_o\mu_r h$
Operating frequency
$f= 1/(2\pi\sqrt{LC})$
Surface Impedance
$Z= JwL/(1-w^2LC)$
Band Width
$BW=Z_0/\varepsilon$
Reflection Phase of surface
$Teta =\tan^{-1}(Z_{HIS}-\eta_0)/(Z_{HIS}-\eta_0)$

## IV. SIMULATION RESULTS

### *A. Return loss*

The return loss for the Elliptical and circular patch antenna s are -29.881dB and -19.98dB respectivly and these are at 5Ω and 10Ω port impedance for respective antennas and the return loss curves are shown in the following figure [3].

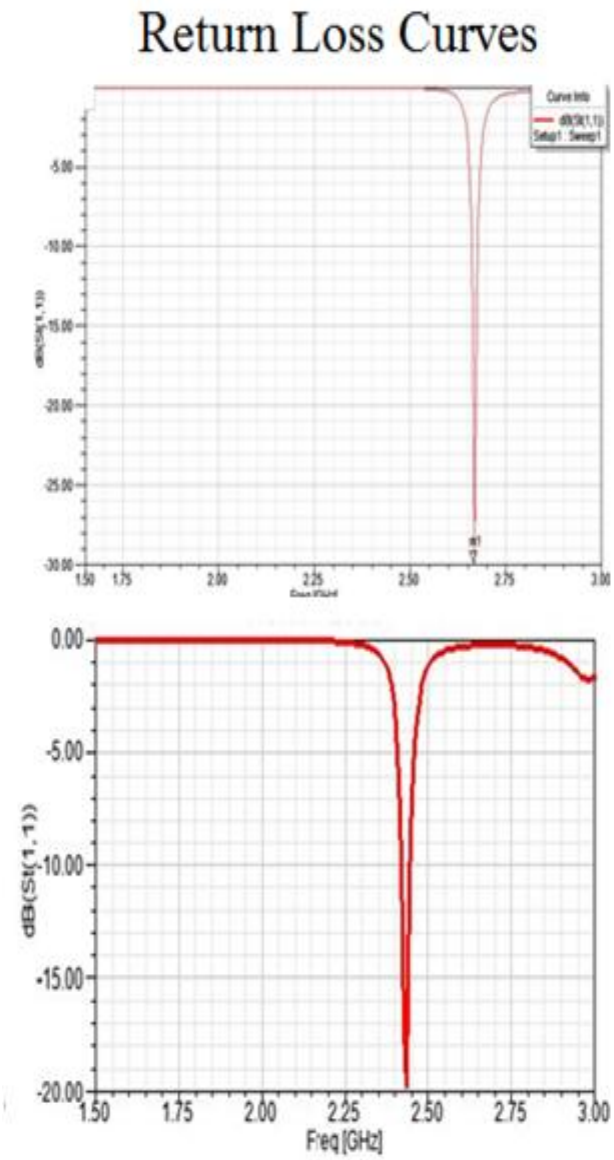


Fig [3]. Retun loss vs frequency curves for Elliptical and circular patch antennas

### *B. Input imedance*

The input impedance for both antennas are illustrated in the following figure [4].

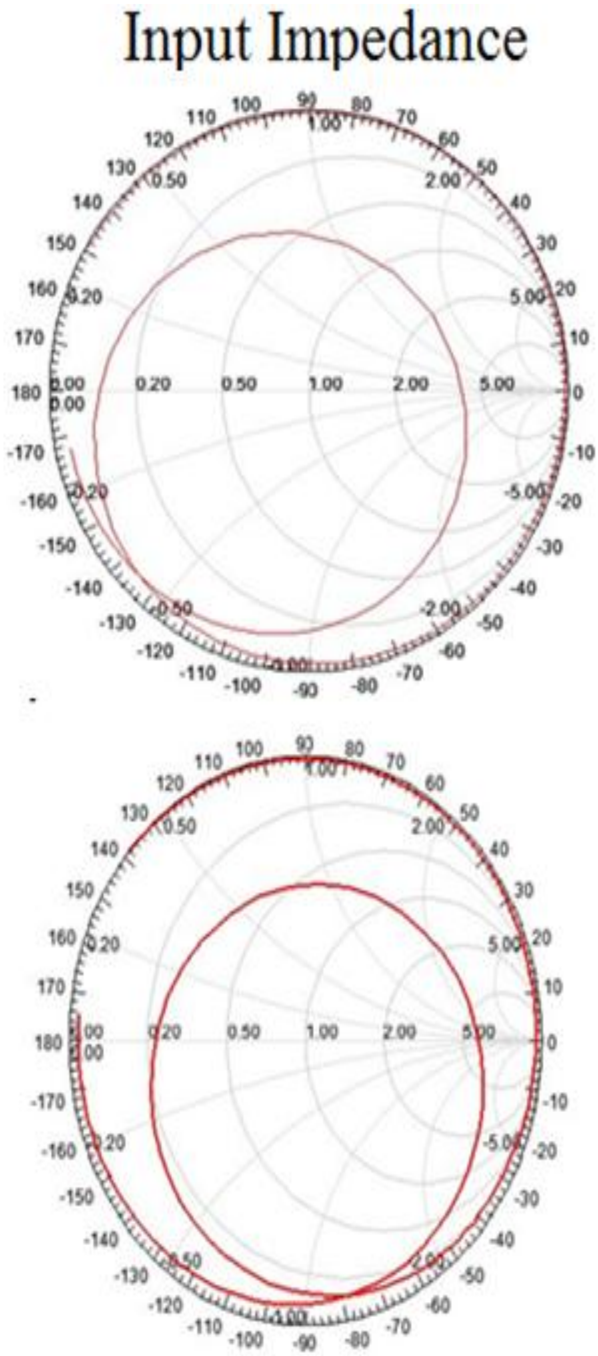


Fig [4]. Impedance curves for Elliptical and circular patch antennas

### *C. Radiation Pattern*

The obtained radiation pattern is enhanced in the opposite direction of HIS and due to the HIS the radiation both antennas are improved form their conventional types i.e in the absence of His and also the back lobes energy also reduced because of HIS and the radiation also improved and the radiation patterns for both antennas are shown in the following fig [5] for radiation pattern for phi and fig [5] for radiation pattern in theta direction.

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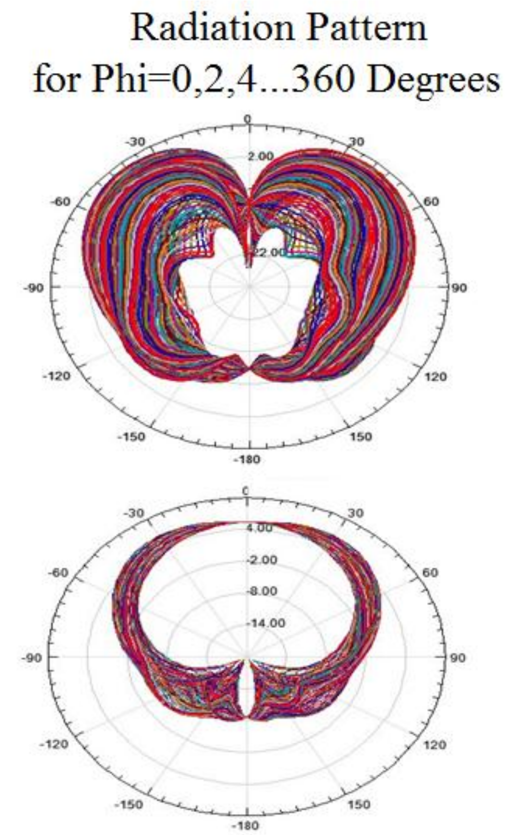
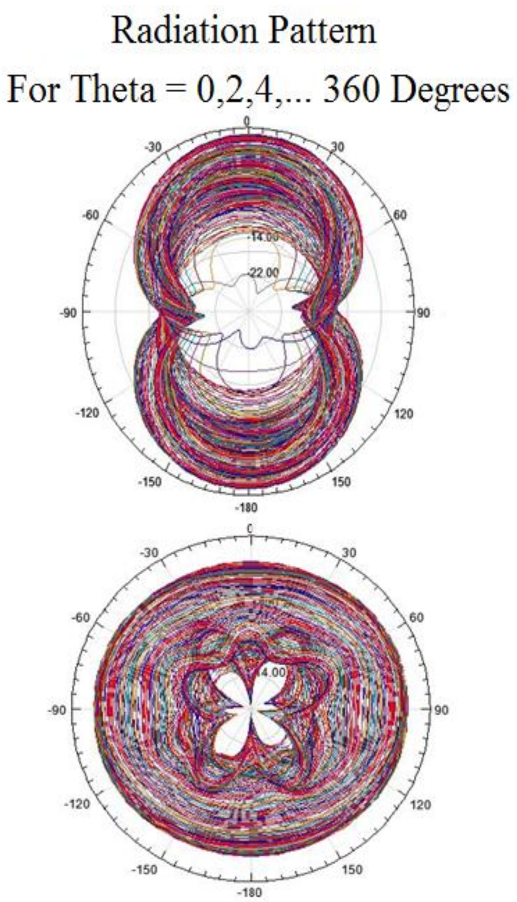



[5]. Radiation patternfor Phi=0,2,4,…360º for Elliptical and circular patch antennas




[6]. Radiation patternfor Theta=0,2,4,…360º for Elliptical and circular patch antennas

*D. 3D-Gain*

The 3D-Gain for designed antennas and their data illustrated in below fig[7] and fig[8] where we can say form fig [8] the both antennas energy maximum in theta direction in phi direction the energy due to surface waves is supressed leaving reduction of back lobes.

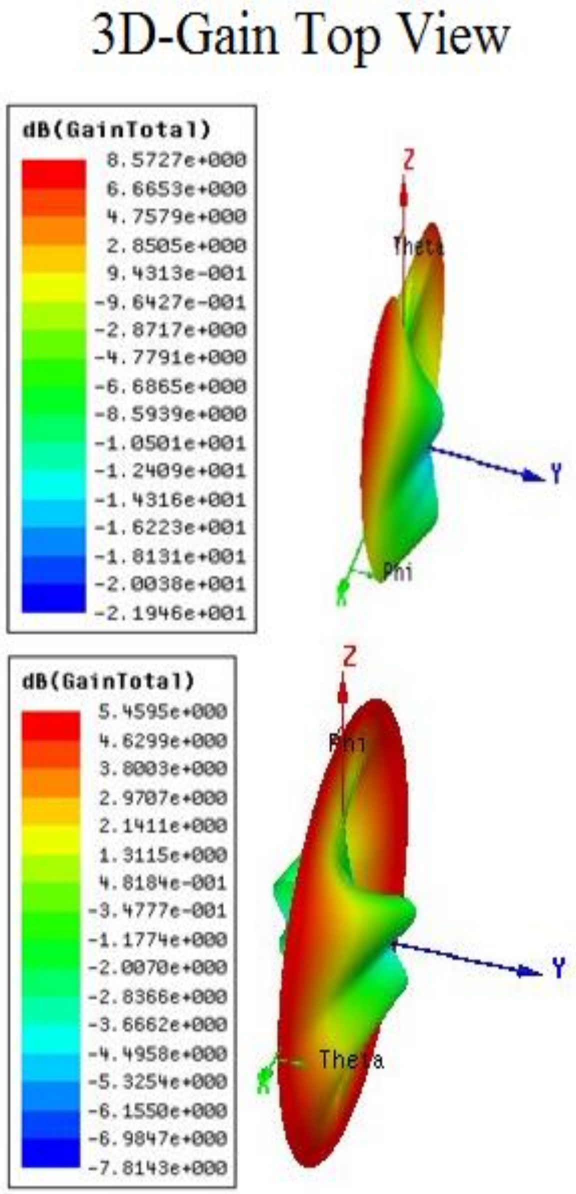



Fig [7]. 3D-Gain in top view for Elliptical and circular patch antennas

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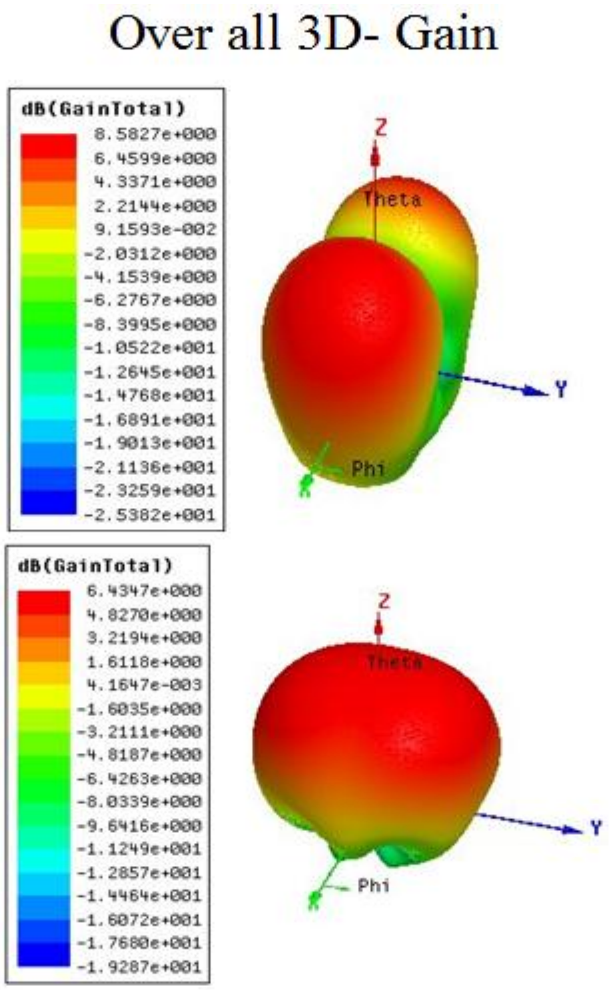


Fig [8]. Over all 3D-Gain for Elliptical and circular patch antennas

*E. Antenna parameters for designed antennas*

By the simulation results the antenna parameters like peak gain, peak directivity, intensity, its radiation efficiency and front to back ratio and its filed distribution are illustrated in the below tables [1] .

| Quantity | Value | |
|---|---|---|
| Max U | 00199301 (W/sr) | 0.00213185 (W/sr) |
| Peak Directivity | 8.01318 | 4.63286 |
| Peak Gain | 7.21552 | 4.40013 |
| Peak Realized Gain | 2.50455 | 2.67902 |
| Radiated Power | 0.00312553 (W) | 0.00578264 (W) |
| Accepted Power | 0.00347106 (W) | 0.00608851 (W) |
| Incident Power | 0.01 (W) | 0.01 (W) |
| Radiation Efficiency | 0.900456 | 0.949764 |
| Front to Back Ratio | 11.8012 | 103.469 |

Table [1] Antenna parameters

From the above table [1] we can say that the intensity and peak realized gain for both antennas are almost same. But peak gain, and directivity for elliptical antenna are very much better than circular patch antenna, and radiation efficiency, front to back ratio are given better values for the circular patch antenna.

## V. CONCLUSION

The HIS structures are often used for so many different application these are also called meta-materials and in the researchers analyzing different design patterns as HIS surfaces and applying them for altering the antenna parameters and for enhancing this paper is to examine how different shape antennas may work are not and their results are affected by HIS.

## REFERENCES.

[1]. J. Doondi kumar , "Analysis of Monopole Antenna by Placing High Impedance Absorber Surface at one Side" /Volume-2Number-1PP-317-321.pdf

[2]. J. Doondi kumar , "Design and Analysis of C0-axial Feed Rectangular Patch Antenna on High Impedance Surface" /Volume-2Number-1PP-405-410.pdf

[3] D. Sievenpiper, "High - Impedance EM surfaces", Ph.D. Dissertation, University of California, Los Angeles, 1999.

[4] D. Sievenpiper, E. Yablonovitch, U.S. provisional patent application, serial number 60/079953, filed on March 30,1998.

[5] Hashmi RM, Siddiqui AM, Jabeen M, Shehzad K, Abbas SM and Alimgeer KS, "Design and Experimental Analysis of High Performance Microstrip Antenna", International Journal of Computer and Network Security, vol. 1, no. 3, (2009) December.

[6] Yang, F. and Y. Rahmat-Samii, \Microstrip antennas integrated with electromagnetic band-gap (EBG) structures: A low mutual coupling design for array applications," IEEE Transactions on Antennas and Propagation, Vol. 51, No. 10, 2936{2946, Oct. 2003.

[7] Sievenpiper, D. F., \High-impedance electromagnetic surfaces," Doctorate thesis, University of California, 1999.

[8] Sohn, J. R., K. Y. Kim, H.-S. Tae, and J. -H. Lee, \Comparative study on various arti¯ cial magnetic conductors for low-pro¯ le antenna," Progress In Electromagnetics Research, PIER 61, 27{37, 2006.

[9] Y. Kotsuka, M. Amano, "Broadband EM Absorber Based on Integrated Circuit Concept", Microwave Symposium Digest, 2003 IEEE MTTS International, Volume 2, 8-13 June 2003 Page(s):1263 – 1266 vol.2.

[10] Kern, D.J.; Werner, D.H.; Monorchio, A.; Lanuzza, L.; Wilhelm, M.J., "The design synthesis of multiband artificial magnetic conductors using high impedance frequency selective surfaces," IEEE Transaction on Antennas and Propagation, Volume 53, Issue 1, Part 1, Jan. 2005 Page(s):8 – 17

[11] C. Balanis, Antenna theory, Analysis, and Design 2nd ed., John Wiley and sons, New York (1997)

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