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A Review on Bow-Tie Microstrip Patch Antenna

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Abstract: ***This paper gives brief over view of the basic features of the Bow-tie patch antenna and then most significantly its development in the recent years. Micro strip antennas are low-profile antennas. A metal patch mounted at a ground level with a di-electric material in-between constitutes a Micro strip or Patch Antenna. These are very low size antennas having low radiation. It gives brief the basic features of the microstrip patch antenna and we have proposed a technique to design and compare a bow-tie patch antenna with the with others and how it's a better option for required options. Its can be designed using various soft computation techniques such as Adaptive Neuro Fuzzy Inference System (ANFIS), Genetic Algorithm (GA) and others. Required platform is used to validate the results. The software used is HFSS software. The design of bow-tie antenna is being developed on a patch. The patch can take many more configurations, the most popular being rectangular, square and circular configurations.***

Keywords: ANFIS, genetic algorithm resonant frequency; gain; efficiency; directivity; optimum solution.

I. INTRODUCTION

Antenna is a device for radiating and receiving radio waves. It is used across systems such as radio and satellite broadcasting, point-to-point radio. Parameters affecting an antenna's performance are directivity, gain, efficiency, resonant frequency and its radiation pattern . A bow-tie antenna is a wire approximation in two dimensions of a bi-conic dipole antenna [1]. It usually consists of two triangular flat metal plates, placed in the configuration of a bow-tie, with the feed point at the gap between the apexes of the triangles.

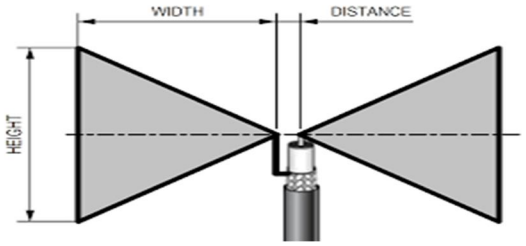

Fig 1. Bow-Tie antenna basic design

It is a broad bandwidth antenna made of two conical objects, nearly touch at their points [1]. It is generally used for UHF television reception [3]. Bandwidth of Bow tie antenna is usually higher than a dipole antenna. It has a omni-directional radiation pattern. It gives a moderate gain of about 3.5-7 dB [2].

It is a miniaturized antenna [3]. Covering the lower spectrum of microwave frequency is a challenging task with help of miniaturized antenna . The French mathematician B. Mandel brott introduced the term Fractal and it is being used for miniaturization of antenna and do provide multiband operation which can achieved over a single antenna. This fractal , mainly has two important characteristics which enable multiband coverage and compactness of antenna – (1) self similarity, and (2) space filling. By using this functionality these fractal structures can be implemented in any antenna for providing broad band coverage applications [1]. Here, the fractal structure is implemented on a bow-tie antenna. Bow-tie antenna can, thus, be regarded as a compact antenna and it can provide multi-band operation [4]. In this project, we design the bow-tie antenna using several soft computation techniques.

This design involves designing a bow-tie antenna on a patch. A patch antenna is also known as a rectangular micro-strip antenna. It is a type of radio antenna with a low profile, which can be mounted on a flat surface. It consists of a flat rectangular sheet or "patch" of metal, mounted over a larger sheet of metal called a ground plane [5].They are usually employed at UHF (Ultra-high frequencies) and higher frequencies because the size of the antenna is directly tied to the wavelength at the resonant frequency. A single patch antenna provides a maximum directive gain of around 6-9 dB. The ability to create high gain arrays in a low-profile antenna is one reason that patch arrays are common on airplanes and in other military applications.

II. DESIGN

A. *Equations*

Bow-tie antenna dimensions can be found out by the use of following simple formulas –

1) Width of the antenna can be calculated by – $W=\frac{c}{2f\sqrt{(\varepsilon r+1)/2}}$ -----(1)

2) The effective dielectric constant is given by – $\varepsilon eff=\frac{\varepsilon r+1}{2}+\frac{\varepsilon r-1}{2}\sqrt{\frac{1}{1+12\frac{h}{w}}}$ -----(2)

3) For TM10 mode, length of patch must be less than λ/2. This difference in length is given by $\Delta L=0.412h\frac{(\varepsilon eff+0.3)(\frac{W}{h}+0.264)}{(\varepsilon eff-0.258)(\frac{W}{h}+0.8)}$ ----

4) The effective length of the antenna is given by $Leff=\frac{c}{2\sqrt{\varepsilon eff}}$ -----(4)

5) The length of the bow-tie antenna can be calculated by – $L=Leff-2\Delta L$ -----(5)

III. LITERATURE SURVEY

Reference [1], Olabisi O , proposed in this paper, dual band Bow-tie microstrip patch antenna has been presented. The design and simulation of the antenna was achieved using HFSS and ADS software. This proposed antenna operates at 2.4 GHz and 5.0 GHz respectively for WLAN applications. The gain of proposed antenna is 6.71 dB with good input reflection coefficient and VSWR. The antenna has shown good performance in terms of directivity and radiation pattern.

Reference [2],D. K. Naji proposes, design of Dual-antenna structures (DASs) for 5.8 GHz RFID systems have been proposed and simulated using conventional and fractal bow-tie patch geometries. An optimization-based approach is introduced to miniaturize the proposed DAS which consists of two antennas, one is the receiving antenna at the upper side, and the other one is the backscattering antenna at the other side.One of the Dual antenna structure desin considered is Bow-Tie antenna and its design parameters.

Reference [4],MNA Karin, insisted on design of the Log Periodic Fractal Koch antennas with three different structures such as the 0th, 1st and series iterations have been designed, simulated and fabricated. The simulated current distribution of the antennas shows a good correlation between radiating elements and resonant frequencies. Moreover, the size of the antennas has been reduced up to 7% for the 1st iteration and up to 26% for series iteration antenna compared to the 0th iteration. The performances of the antennas are maintained throughout the frequency range of the designed.

Reference [7],Jang, tried to reveal that ANFIS modeling with SC-ANFIS can be a useful approach in the characterization of water quality in the form of water quality index. Since the approach tries to otherwise the lengthy computations of WQI, the present study holds its importance in developing a model and employing it for faster dissemination of information as well identifying the critical water quality parameters affecting WQI. The SC-ANFIS model, because of its good predictability over the FCM-ANFIS model, was further used to perform sensitivity analysis. The effect of perturbation in each water quality parameter was modeled and analyzed.

Reference [9], In this paper author, proposed antenna is designed to operate at lower spectrum of microwave frequency. Koch like sided antenna is designed on the normal bow tie antenna to achieve a multiple resonance in the single antenna has made. Thus, the proposed antenna has cover the application including GSM upper (1.8GHz), GSM lower (850 MHz), 3.5 GHZ and 5 GHz of wireless applications. Reference [12], Here author,deals with,design of a microstrip antenna and optimize by generic algorithm. In this design for large bandwidth optimizing based on Finite deference time domain(FDTM) and generic algorithm(GA). For wide band width Generic algorithm link with Finite deference time domain (FDTM). Patch of this antenna was divide in to number of cell, each iteration of generic algorithm (GA) randomly selected cell was cut and bandwidth checked. this process repeated until good bandwith was found. Reference [13], M. Jamshidifar, has develop a new approach to enhance the bandwidth of a novel miniaturized fractal microstrip patch antenna. Microstrip antenna has advantage that lower size and weight but some limitation such as narrow bandwidth and large size in small frequency application but after investigation of this type of technique size reduce up to 68% and bandwidth increase 27% . IE3D is used as simulation software a new feeding technique called sleeve feeding method used in this antenna. Reference[14],Chopara Vandana, proposes design single feed compact rectangular microstrip patch antenna for triple band application, for more efficient design optimization of antenna parameter is done by HFSS software. This antenna has three reson –ence frequency at 2.33GHz, 7.60GHz, 8.53GHz and band width 102MHz, 130MHz, 127MHz and return loss is -15.80db, 18.7 db, 36.57db respectively. This antenna has application in wireless communication ,RADAR,WLAN Reference[15]S. kohali ,has proposed to design and optimization of multiband fractal microstrip antenna for wireless application. This antenna is design by using IE3D simulation software. On the square patch there are three iteration applied one by one. then result of fractal patch antenna resonate at 4.7GHz, 6.5GHz, 7.69GHz and 8.5GHz and bandwidth

of 150MHz, 135 MHz, 520 MHz and 1.2 GHz respectively at corresponding frequency This antenna is popular in defense and secure communication, c band and x band applications Reference[16]S Samundra, design a rectangular microstrip patch antenna array for c band scatterometer and MBI. Range of C band is 4GHz to 8GHz, then design of this rectangular patch antenna the line feed and central frequency of 7.8GHz For scattrometer. Design of single element and 2×2 array are simulated in computer simulated tool. In antenna design RT-duro –id substrate used with dielectric constant of 2.2 and substrate thickness is 1.574 . the directivity and gain can be improve by array structure. 12.1db is directivity and 11.61 db gain was achieved and good return loss at central frequency 7.80GHz.

IV. CONCLUSION

In this review paper show the primary characteristics of microstrip patch antenna ,different technique use in design, different shape of patch taken ,different feeding technique and different type of substrate use in the design of this antenna for reducing size and weight and increasing bandwidth, gain etc. microstrip antenna useful in wireless communication, RADER , WLAN, etc due to their small weight and size.It has been observed that using various soft computation methods, bow-tie antennas gives better directivity, gain and antenna efficiency. Bow-tie antenna is a miniaturized antenna and it is used Ultra-High Frequency (UHF) television reception. It gives optimized values of the antenna parameters as chosen. The ANFIS technique gives the most directive antenna, however more gain is obtained using the genetic algorithm technique. The hybrid model consisting of both genetic algorithm and ANFIS gives the highly efficient antenna. So, the soft computation techniques can be opted according to his requirement. Bow-tie antenna is a bi-conical antenna which is usually multiband. Because of their broadband characteristics, it can be employed in the Very High Frequency (VHF) and Ultra High Frequency (UHF) frequency ranges [7]. It is very useful antenna as it can be grossly used in higher frequency ranges, it is a multiband antenna, it gives good directivity and it is small in size and easy to design , efficiency and gain. The increased demand for communication , the use of band has gone from narrowband to wideband and broadband within a very short time. To meet the increasing demands, more efficient antennas are required such as bow-tie patch antennas .

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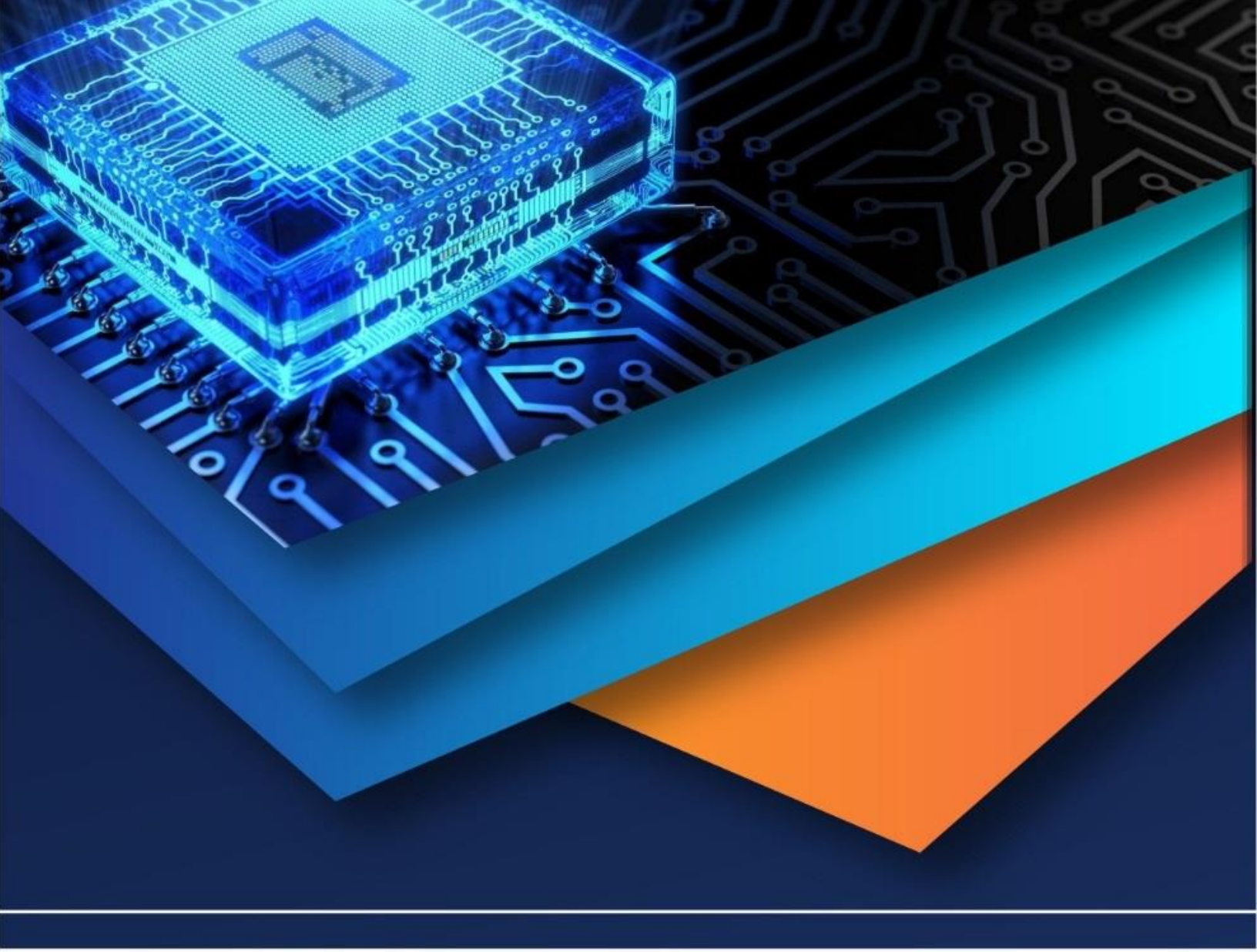

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