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A Review on Microstrip Patch Antenna

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Abstract: ***microstrip patch antenna (MSA) is one of the advance and ingenious antenna in the antenna theory. Due to their small in size and small in volume, low manufacturing cost so it is suitable in wireless communication and other device where required small size of antenna, but some disadvantage like low bandwidth, low gain. This paper gives brief over view of the basic feather of the microstrip patch antenna and then most significant development in this antenna theory in the recent year.***
Keyword- Microstrip Patch Antenna (MPA), feeding technique, Patch, fractal geometry

I. INTRODUCTION

The Microstrip antenna was first design in 1950, but after 1970 this is most common and advance type of antenna after develop printed circuit board (PCB). During last some year microstrip antenna is most popular antenna in the telecommunication field. Due to some advantage like small in size and weight, low manufacturing cost, reliability,easy in fabrication and some drawback like low bandwidth, low gain etc. Simple diagram of microstrip patch antenna show in the fig.1 in this fig show that microstrip antenna consist of a patch (like circular, rectangular, ellipse, ring or any other type of shape)and ground plane between theme a substrate, having particular value of dielectric constant. Dimension of ground plan and substrate plan are larger than compare to patch. Dimension of the patch . dimension of patch depend on dielectric constant of the substrate and resonance frequency of the antenna. Microstrip feed line and patch are conected by photo etched on substrate.

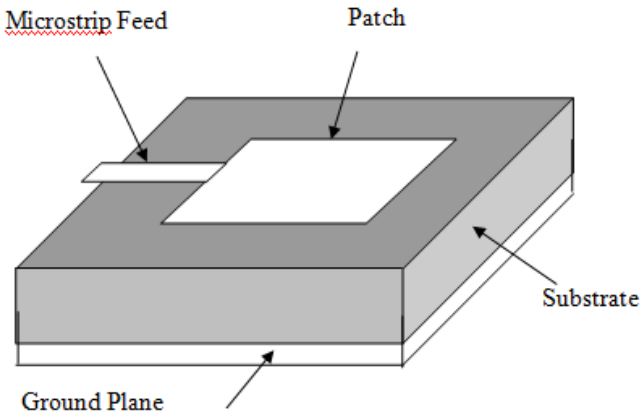

Fig. 1 Simple diagram of microstrip antenna

Size of antenna decrease by increasing the number of iteration and bandwidth of microstrip antenna increase by a number of slot over the patch. If bandwidth increase then Q factor decrease and inductance increase by equation (1)

$$\text{Bandwidth (B)} = \frac{1}{Q\sqrt{2}} \quad (1)$$

II. ANTENNA DESIGN

For design a microstrip antenna select a resonance frequency and dielectric constant of the substrate then after width of patch of the antenna calculated by equation no. (2).

$$W = \frac{c}{2fr}\sqrt{\frac{2}{\varepsilon r+1}} \quad (2)$$

Where, W=width of the patch, c=speed of light, Ɛr=dielectric constant

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Determine the value of dielectric constant from following equation no (3)

$$\varepsilon reff = \frac{\varepsilon r+1}{2} + \frac{\varepsilon r-1}{2}[1 + 12\frac{h}{w}]^{-1/2} \quad (3)$$

Increase in length (ΔL) can be calculated by equation no. (4)

$$\frac{\Delta L}{h} = 0.412\frac{(\varepsilon reff+0.3)\left(\frac{w}{h}+0.264\right)}{(\varepsilon reff-0.258)\left(\frac{w}{h}+0.8\right)} \quad (4)$$

Where; h is the substrate height

Length (L) is determine by equation no. (5)

$$L = \frac{C}{2fr\sqrt{\varepsilon reff}} - 2\Delta L \quad (5)$$

Dimension of the ground is determine by

$$L_g = L + 6h$$

$$W_g = W + 6h$$

Where; L_g is length and W_g is width of ground.

III. LITERETURE SURVEY

Reference[3],T. A. Denidni et al. in 1998 Has design a broadband microstrip patch antenna for wireless application. The design of broadband microstrip patch antenna fulfill the goal of wireless communication because in wireless communication device low in weight and size for this reason microstrip antenna is a suitable choice in this field. microstrip antenna have a some drawback is their bandwidth 1-2% but after investigation of this broadband microstrip patch antenna this problem have been removed by designer .

Reference [4], M. Jamshidifar, et al. in 2005 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 [5], Abas Sabouni, et a l in 2005,design 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[6],Chopara Vandana, et al. in 2013, 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[7]S. kohali et al in 2013 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 most popular in defense and secure communication, c band and x band applications

Reference[8] Ajay kumar, et al in 2013 has design a microstrip antenna, bandwidth improved by mushroom type EBG structure because demerit of microstrip antenna has lower bandwidth. In this design used mushroom type for suppressing the surface waves EBG structure by visa patch are connected to the ground plane, stop band frequency is the important characteristic of EBG structure. The surface wave of the proposed antenna are suppress by help of stop band. The bandwidth of this patch antenna increase by 5.9%by the help of suppression of surface wave.

Reference [9] Tandel Tejal, et al in 2015,design a coaxial feed microstrip patch antenna for WLAN application, this antenna has been design by etching L-shape structure on rectangular patch. For desire bandwidth this antenna design by thick substrate FR4 with dielectric constant 4.4 and antenna is simulated by CST simulator at5.15GHz and return loss is -25.39db, directivity of this antenna

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is 6.35dbi.

Reference[10] Arief B. Santiko,et al in 2016 has design a multi layer parasitic substrate for improve the gain of microstrip patch antenna. In this approached for improving main lobe of antenna, the separation between first parasitic layer and second parasitic Layer is to be optimize for maximum electromagnetic coupling. This Antenna is fabricated by using FR-4 substrate with 4.2 dielectric constant. this technique increase the gain of antenna is 5.10 db without reducing the bandwidth of antenna .The design concept of this antenna is similar to parasitic element of yagi antenna.

Reference[11]S Samundra ,et al in 2016, 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.

Reference[12], Xiaosheng Geo, et al in 2016 design a inverted T-slot circular microstrip patch antenna with dual band at 2.4GHz and 5.5GHz. design on a substrate FR4 with dielectric constant is 4.3 and loss tangent is 0.04 with size of ($30mm\times30mm\times30mm$) and radius of circular patch is 11.4mm and feed by coaxial feed cable. This antenna is simulated by CST microwave studio 2015.

IV. CONCLUSION

In this review paper show the basic characteristic 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.

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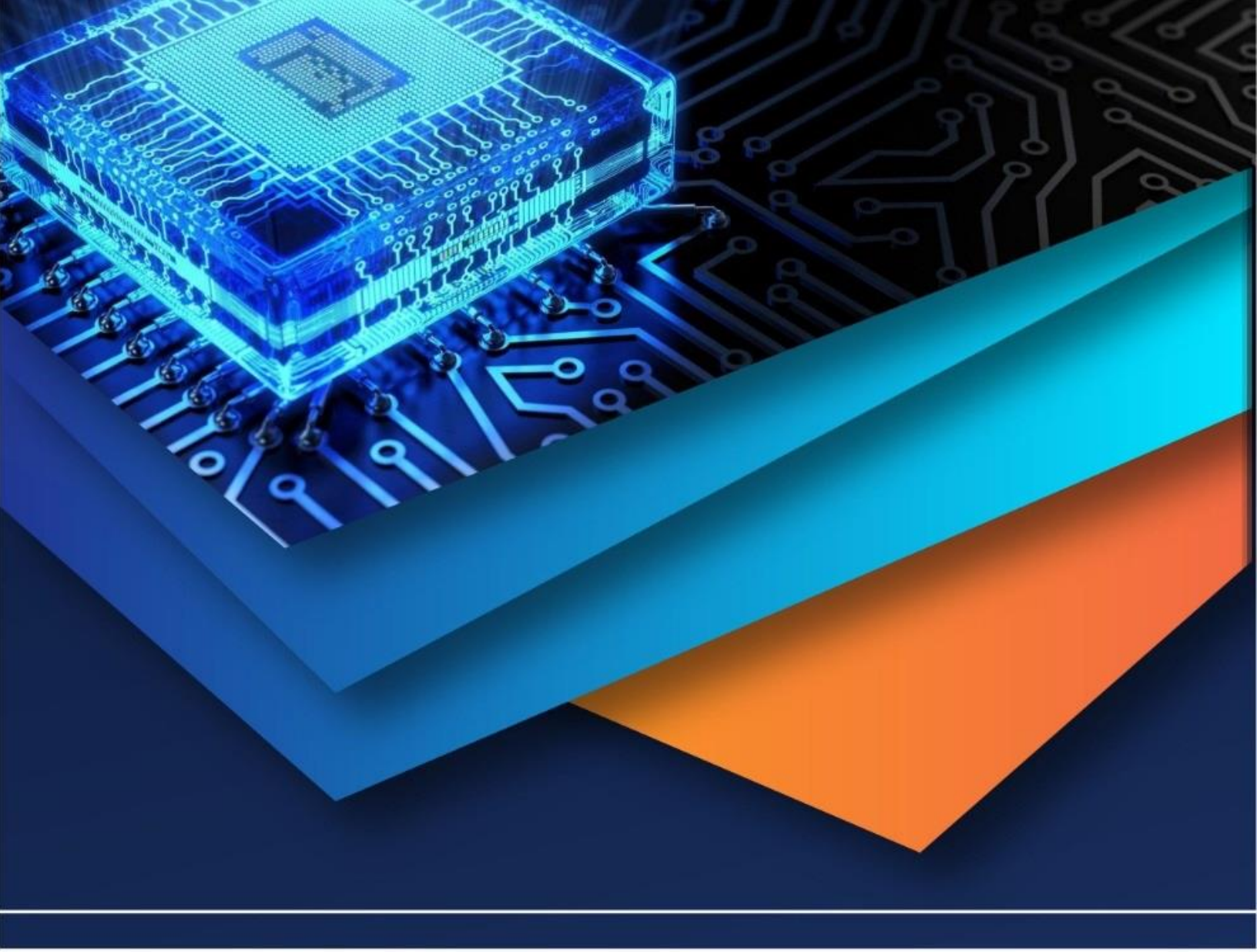

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