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A Review Paper on Circularly Polarized Microstrip Antennas (CPMAs)

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ABSTRACT: A survey on circularly polarised microstrip antennas and their historical perspectives is defined in this paper. As one of the regular planar antennas, circularly polarised microstrip antennas have been extensively studied in the last few decades. In radar and wireless communication systems, circularly polarised microstrip antennas are widely used because they allow the transmitter and the receiver to be flexibly focused. Owing to their narrow circularly polarised radiation (3-dB axial ratio) and impedance bandwidths, most of them cannot be used in ultra-wideband (UWB) applications.To improve the desired level of performance parameters such as resonance frequency, gain, directivity, radiation efficiency, and antenna efficiency for the dual resonance, there are many techniques for designing circularly polarised microstrip antennas. Circularly polarised microstrip antennas, literature review, simulation tools, benefits and drawbacks over traditional microwave antennas and applications are listed in this letter. The comparative analysis of several circularly polarised methods of microstrip antenna design used by researchers is also discussed in this paper.

KEYWORDS:Communication System, Global Positioning System (GSM), Microstrip Patch Antenna, Patch Antenna, Wideband Antenna.

INTRODUCTION

The circular polarization delivers better connectivity with both fixed and mobile devices. Rapid development in the wireless communication system,low profile and wideband antennas with good radiationperformance are in great demand, particularly in spaceapplications such as satellite, aircraft, and radar. The slotantennas are suitable for these application because their tempting characteristics such as low profile, planar geometry,wideband, and easy integration with planar circuits.

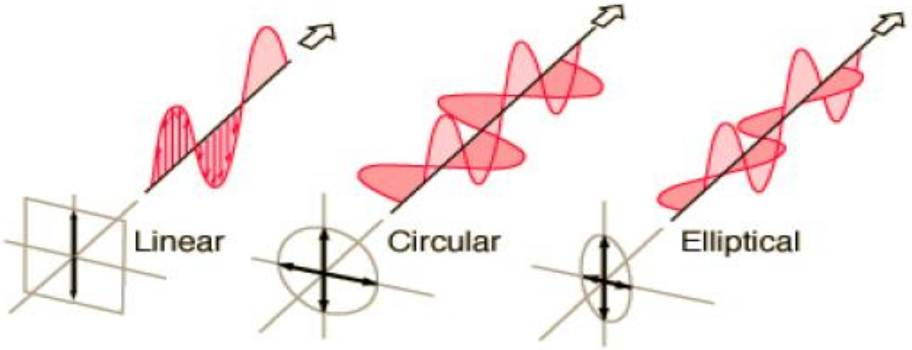

Figure 1: Illustrates types of polarization.

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Since the electric and magnetic field vectors are always related according to Maxwell's equation, it is enough to specify the polarization of one of them. And commonly it is specified by the electric field. Polarization should be defined in its transmitting mode with reference to IEEE norms[1]. The polarization plane is the plane containing the electric and magnetic field vectors and it is ever perpendicular to the plane of propagation. The contour drawn by the tip of the electric field vector describes the wave polarization.

Recent advances in the wireless communication industry continue to derive requirements from lightweight, compatible and inexpensive microstrip patch antennas in today's world of wireless communication[2]. A patch antenna is a narrowband, wide beam antenna produced by etching the pattern of the antenna part in metal trace attached to an insulating dielectric substrate such as a printed circuit board with a continuous metal layer attached to the opposite side of the ground plane shaping substrate[3].

The width W of the microstrip patch antenna is calculated by using the following equation.

$$w = \frac{c}{2\, f_r \sqrt{\frac{(\varepsilon_r+1)}{2}}}$$

Where

'f_r' denotes the resonant frequency, and

'r' represents substrate dielectric constant

The effective dielectric constant (ε_{reff}) of antenna is derived by applying the given equations.

$$\varepsilon_{reff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2} \sqrt{\left(1 + 12\frac{h}{W}\right)}$$

Where h denotes the height of the antenna and W denotes the width.

The length of the antenna may be measured by applying the following equation.

$$L = \frac{c}{2\, f_r \sqrt{\varepsilon_{reff}}}$$

The antenna length extension is calculated by applying the equation below.

$$\Delta L = 0.412\, h\, \frac{\left(\varepsilon_{reff} + 0.3\right)\left(\frac{W}{h} + 0.246\right)}{\left(\varepsilon_{reff} - 0.258\right)\left(\frac{W}{h} + 0.8\right)}$$

Here W represents the width and h denotes the height.

The real length (L_{eff}) of the antenna can be calculated by using the following formula.

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

LITERATURE REVIEW

The literature survey revealed that Deschamps first suggested the notion of the Microstrip radiator in 1953. A patent was given on behalf of Gutton and Baissinot in France in 1955. Production was accelerated by the availability of good substrates during the 1970s. Howell and Munson created the first practical antenna[4]. Extensive research and development on Microstrip antennas has since been aimed at maximising their benefits.

Kumar et al. conducted a research on circularly polarized microstrip patch antenna.For mobile communication and GPS applications, a triple-frequency single-feed S-shaped circularly polarised microstrip antenna with a limited frequency ratio has been proposed. In the centre of a square patch of 84.5 to 84.5 mm2 for multi-band service, an S-shaped slot is removed. The proposed antenna geometry consists of a single microstrip line with an aperture-coupled feeding structure. The results of the simulation show that the proposed antenna can be used with an efficient return loss of -34.34 dB, -18.23 dB and -24.75 dB at 1.193 GHz, 1.454 GHz and 1.615 GHz respectively for multi-band service[5].

DISCUSSION AND CONCLUSION

During the last decade, several circularly polarised microstrip antenna configurations have been recorded. Triple frequency S-shaped circularly polarised microstrip antennas (CPMA) with a low frequency ratio were investigated by various researchers across the globe. The antenna consists of various shaped slotted patch with a feeding arrangement coupled with an aperture. This paper is a study of techniques and techniques for circularly polarised microstrip patch antenna design. Day by day, the technologies used and the research work increase the usage and reliability of the Micro strip antenna and allow it to be used further in the future. The gain and bandwidth of the Antenna Micro strip is increased by various techniques. Because of this survey effect, the disadvantages of CPMAs can be minimised. The low gain and power handling capability of the array design can be compensated for. The feeding strategies optimise their outcomes as well. Several simulation tools have been built for micro strip antennas that make it simple and accurate to correctly construct e-antennas.

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