INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Dual polarized planar antennas have great potential to increase channel capacity and minimize space requirement in modern wireless communication. Such antennas should essentially have highly decoupled ports and broad bandwidths that will reduce receiver complexity in communication systems. Of special interest are dual circularly polarized (DCP) antennas have superior properties compared to dual linearly polarized antennas and therefore find their utility in satellite communications, radars, altimetry, etc. This thesis therefore begins with the theory of planar antennas i.e. microstrip antennas and slot antennas exploring methods of generating circularly polarized (CP) waves from these antennas. A detailed study of the existing DCP antennas and port-decoupling in dual linearly polarized (DLP) antennas is made from which it is inferred that many of the techniques employed in the latter can be incorporated in the former for better port isolation. Moreover, since the bandwidths of the DCP antennas should be large, CP slot antennas can be possible candidates for extension to their DCP counterparts. It is with this rationale, three different kinds of DCP slot antennas employing different port-decoupling techniques have been presented. The first two antennas have slotted ground apertures excited by feed-lines with port-decoupling accomplished by means of interdigital capacitor and split-ring resonator-based meta-surface which shows the characteristics of an electromagnetic bandgap (EBG) structure. Furthermore, to overcome the issue of low gain in slot antennas, a series-fed array of slots backed by a metallic reflector is designed which has a high gain apart from other useful properties namely high port-isolation and broad impedance and AR bandwidth. In this antenna, in spite of its ostensibly simple structure, a number of geometric parameters were found to tightly control its overall performance in general and the axial ratio (AR) and gain in particular. We have also demonstrated that using parasitic patches and defected ground structure (DGS) in a DCP patch antenna can greatly enhance its properties namely – impedance bandwidth, axial ratio bandwidth, gain, cross-polarization discrimination and interport isolation. In all these cases, details of design and mechanism of action are discussed. The simulated results are observed to reasonably tally with the measured data. Additionally, MIMO parameters, namely envelope correlation coefficient (ECC) and diversity gain (DG), were calculated for each of the novel antennas presented here.