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Seminar

Institute for Plasma Research

Title : Design and Characterization of High Performance Circularly Polarized Planar Antennas for Wireless Communication

Speaker: Dr. Rohit Kumar Saini
IIT, Dhanbad

Date : 01st October 2021 (Friday)

Time : 10.30 AM

Venue : Online - Join the talk:

https://meet.ipr.res.in/Dr.RohitKumarSaini_PDFTalk

Abstract :

Planar antennas and arrays have been widely used in recent years because of their good characteristics such as low cost, small size, lightweight, conformal configuration and compatibility with MIC/MMICs. These features make the planar antennas very attractive for use in high-speed vehicles, such as missiles, rockets and satellites, where wind resistance and payload are major considerations.

Circularly polarized (CP) antennas have received considerable attention for deploying a transmitter and a receiver without causing a polarization mismatch between them. In communication with satellite and space vehicle which are located above the earth's ionosphere, circular polarization is preferred over linear polarization. In operating radar in raining weather, circular polarization is found to minimize the clutter echoes received from raindrops, in relation to larger targets such as an aircraft. By using the circular polarization in wireless communication systems, arranging the orientation of the antennas between the transmitter and receiver is not needed any more. The antenna having wide bandwidth is very much promising for high data rate wireless technology. In the light of above views, broadband CP antennas are becoming very important. Single fed and single element antennas have advantages of small volume and do not need power divider circuits in comparison with multi feed and array antennas. Printed CP slot antennas having inherent wideband characteristics are found in various applications. Interest is growing to design dual-band dual-sense antenna. Here, the right-hand CP and the left-hand CP can be achieved simultaneously. The characteristics of multi-band and multi-polarization are very beneficial to reduce the interference effect. Moreover, they are very useful for the application of frequency reuse or polarization diversity. Polarization reconfigurable antennas by altering polarization characteristics can be used in polarization diversity system. An advantage of polarization diversity function is that, to suppress fading caused by multipath propagation. Multipath propagation can degrade received signal quality severely.

This dissertation emphasizes the designing and analysis of CP slot and monopole antennas. In this thesis, the CP slot antennas are designed for Global Positioning System (GPS; 1.575GHz), Digital Communication System (DCS; 1.71-1.88GHz), Bluetooth/WLAN (2400-2484 MHz) and Wi-MAX (2500-2690MHz, 3200-3800 MHz) applications. The proposed antennas are compact in size and can be fabricated easily. The proposed designs of CP slot antennas have wideband and multiband of CP. The studies have been carried out in this thesis, covering the areas of multi-band and multi-polarization antenna. In addition, reconfigurable multi-band and multi-polarization is designed which has different polarization states by controlling the biasing state of switches. In order to understand the antenna operations the design parameters of proposed antenna are also analyzed extensively for achieving optimal operation of the antennas. The proposed CP slot antenna exhibits a nearly bidirectional radiation pattern with good cross polarization level approximately ≥ 20 dB in the direction (+z) of maximum radiation in both planes (XZ- and YZ-Plane).

Finally, the simulated designs are fabricated experimentally and results are measured in anechoic chamber that validate the design approaches.
