ON SOME NOVEL TECHNIQUES TO REALIZE MULTI POLARIZATION / MULTI FREQUENCY SHARED APERTURE ANTENNA

ABSTRACT

This dissertation mainly focuses on some shared aperture antenna configurations explored in view of achieving improved characteristics for practical applications. The works include theoretical design, parametric studies, investigations using commercial EM simulators, and finally experimental validation of the proposed designs. A shared aperture antenna indeed accommodates the functionalities of different antennas in one aperture, which invites several technical challenges. This needs accurate optimization of a number of antenna parameters simultaneously.

The dissertation embodies seven chapters. Chapter 1 contains a comprehensive review of known and relevant developments reported so far, and also the recent trends and directions of new requirements. Chapter 2 describes a dual linearly polarized (LP) antenna using square patch as the basic radiator. The dependency of inter-port isolation on positions of the coupling apertures has been reported for the first time. Inter-port isolation and cross polarization discrimination are higher than the earlier reported results. Chapter 3 presents a composite feed dual circularly polarized (CP) microstrip antenna with axial ratio bandwidth (without using power divider) and inter-port isolation much improved compared to earlier reports. The dependency of inter-port isolation on coupling slots has been thoroughly examined to realize a dual CP antenna. Chapter 4 deals with the design and development of a dual CP conical horn employing a metallic stepped septum in the circular waveguide. Closed form expressions for the optimized dimensions of different parts of the septum have been proposed.

A shared aperture dual configuration reflector antenna with improved features has been documented in Chapter 5. It works in cassegrain configuration at Ka-band and in prime focus mode at S-band employing the same main reflector and a curved frequency selective subreflector. The antenna is dual LP at S-band and dual CP at Ka-band. Chapter 6 describes a new technique to realize two identical polarizations at two different frequencies: This composite configuration uses two elements of reduced width (= 50 % of a conventional patch) fed by a single feed line. Chapter 7 summarizes the work indicating possible applications and future scope. The dissertation is based on 3 journal publications 1 being published in IEEE AP Transactions and rest 2 in Microwave and Optical Technology Letters.

Satyajit Chakrabarti
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