POLARIZATION AGILE MICROSTRIP ARRAY ANTENNA ELEMENT 55

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ABSTRACT

A new microstrip antenna element is described which exhibits polarization agility. This is achieved by employing a T-slot radiator which is driven by the edge fields of a balanced microstrip line. The balanced line can support two propagating modes, namely, an even mode and an odd mode, and by switching between these modes, the orthogonal arms of the T-slot radiator are separately excited thus forming orthogonally polarized radiated fields. A microstrip patch antenna, which displays polarization agility using the same mechanism, is also described.

INTRODUCTION

Many modern radar roles such as the suppression of rain and sea clutter, the determination of target signatures and electronic countermeasures call for antennas which are polarization agile. In principle, polarization control can be achieved with any antenna which is capable of radiating two independently adjustable (in amplitude and phase) orthogonal field components. In the case of conventional high gain reflector antennas, for example, adjustable polarization can be achieved by using a dual-polarized feed (usually a horn) to illuminate the reflector together with a polarizing network.

A similar solution exists for array antennas, by appropriate excitation of independently fed array elements comprising horns, or any equivalent dual-polarized radiator. However, such arrays are generally large and expensive and consequently are usually inappropriate to many airborne and some seaborne radar roles. In such roles antenna arrays for radar are comprised essentially of two basic low-profile and lighweight types. These are slot arrays fed from waveguide, stripline or microstip, or patch antenna arrays fed from microstrip or stripline.

Slot array antennas, fed from waveguide, have been under continuous development for almost 50 years since the pioneering work of Bethe [1], Stevenson [2], and Watson [3]. Much of the ensuing developments have been related to fixed polarization geometries, since the elemental slot radiator provides radiations which are invariantly polarized in a direction perpendicular to the major axis of the slot. Consequently, to achieve polarization agility in a slot array antenna a radiating element comprising two mutually perpendicular slots is usually required, suitably fed to permit independent control of the magnitude and phase of their radiations. Several schemes aimed at procuring polarization agility have appeared in the literature and the advantages and disadvantages of most for the various configurations which have been proposed are summarized in Ref. [4].

It is conluded in Ref. [4] that optimum polarization control of waveguide slots is afforded by the use of *T*-shaped slots in a bifurcated waveguide, control being achieved by independent adjustment of the even and odd modes of the waveguide. This method of control can also be applied to slots excited by other waveguiding systems provided that an even and an odd mode can be supported by the system. This article de-

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