Modal Analysis of a Planar, Printed Array for Weather Measurement

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A study of planar and dual-polarized antenna arrays is performed as relates to the modal content of the scattered electric fields. The proposed radiating element of the array has a simple dual-probe feed and features simple, low cost construction on a printed circuit board. This low cost approach is very attractive for multifunctional phased arrays that consist of many elements, implying large cost construction. An analysis of array this element led to the conclusion that array scan performance is highly dependent on its scattered field distribution.

To better understand the importance of the array element's field distribution and its impact on array scanning performance, the array was modeled using periodic boundary conditions around the unit cell. The excitation on the array was a plane wave since the excited TE and TM modes will be the same when the array is operated in the transmit mode. As the plane wave impinges on the array, the electric field will scatter into propagating and evanescent higher order modes. Eventually, a set of dominant modes will be sustained on the array's unit cell whose excitation strength is based on the angle of incidence.

The numerically model the supported fields by the array unit cell, the modes are decomposed in a set of orthonormal basis functions associated with the TE and TM modes. The strength of these modes are then computed via projection to the scattered electric fields on the unit cell and as a function of the scan impedance. It is concluded that for a stable scan impedance, the array element fields must exhibits a constant modal amplitude across the scan angles. At the meeting, it will be shown that dual-polarized antenna elements can be realized by controlling the modal distribution of the electric field by locally modifying the geometry of the radiating element.