Abstracts

Theory and Numerical Calculations for Radially Inhomogeneous Circular Ferrite Circulators

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This paper presents a new theory for the operation of microstrip and stripline circulators, specially set up to permit radial variation of all the magnetic parameters. A computer code, taking only a few seconds per calculated point on a modest computer, was developed from the theory, and calculated results are given. In the theory we develop a two-dimensional (2-D) recursive Green's function G suitable for determining the electric field E, anywhere within a microstrip or stripline circulator. The recursive nature of G is a reflection of the inhomogeneous region being broken up into one inner disk containing a singularity and N annuli. G has the correct properties to allow matching to the external ports, thereby enabling s-parameters to be found for a three-port ferrite circulator. Because of the general nature of the problem construction, the ports may be located at arbitrary azimuthal angle Phi and possess arbitrary line widths. Inhomogeneities may occur in the applied magnetic field H/sub app/, magnetization -4piM/sub s/, and demagnetization factor N/sub d/. All magnetic inhomogeneity effects can be put into the frequency dependent tensor elements of the anisotropic permeability tensor. Numerical results are presented for the simpler but immensely practical case of symmetrically disposed ports of equal widths taking into account these radial inhomogeneities. Studies of breaking up the area into 1, 2, and 5 annuli are undertaken to treat specific inhomogeneous problems. The computer code which evaluates the recursive Green's function is very efficient and has no convergence problems.

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