Abstracts

Analysis of ferrite circulators by 2-D finite-element and recursive Green's function techniques

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Ferrite circulator operation is analyzed here by two techniques. The first employs a two-dimensional (2-D) finite-element (FE) technique, using a publicly available FE package. We show how to adapt this code to the solution of the magnetostatic equations and solve for the distribution of internal magnetic field inside a round ferrite puck of finite thickness, and use it to verify existing approximations for the demagnetizing fields. Additionally, the 2-D FE method has also been used to calculate the RF fields and scattering parameters in circulators having noncircular shapes, as well as nonuniform material properties and bias conditions. We have also investigated the field solutions for round circulators, calculated using a recursive Green's function (RGF) technique. This technique allows for radially varying properties in the material or bias fields, and thus accommodates the nonuniform demagnetizing field distribution in finite pucks. A comparison of the results of this technique with experiment is made. We show how the impedance-matching structures attached to the circulator affect the field distributions inside, and present plots of the field distributions as a function of frequency, which provide insight into circulator operation.

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