Abstracts

Analytical Dispersion Analysis of Loaded Periodic Circuits Using the Generalized Scattering Matrix

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The dispersion characteristics of periodic circuits are typically determined analytically using idealized circuit models. Idealized circuit models exclude the effects that circuit asymmetries, such as those created by coupling ports, have on accurately determining the system normal mode dispersion characteristics for physically loaded periodic circuits. A new analytical dispersion analysis technique has been developed to accurately predict the dispersion characteristics for loaded periodic circuits. The loaded periodic circuit dispersion analysis problem is resolved using the frequency dependent mode matching algorithm, which yields regional normal mode scattering information for the circuit in the form of the generalized scattering matrix (GSM). The GSM is manipulated to determine the normal mode amplitudes for each region of the periodic circuit, where the resulting regional normal mode amplitude information is used to construct electro-magnetic field maps for the length of the periodic circuit. Spatial Fourier analysis of a frequency-dependent field map determines the periodicity of the spatially dependent field. The resulting frequency-dependent spatial Fourier harmonic information is used to construct three-dimensional (3-D) and two-dimensional (2-D) system normal mode dispersion diagrams for loaded periodic circuits. The 2-D and 3-D dispersion diagrams define the phase, frequency, and relative amplitude characteristics of the periodic circuit system normal modes excited by the coupling ports. The system normal mode amplitude information defines the relative level of excitation for a given mode in comparison to other modes on the dispersion diagram.

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