Abstracts

Nonlinear Analysis of Microwave Superconductor Devices Using Full-Wave Electromagnetic Model

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This paper presents a full electromagnetic wave analysis for modeling the nonlinearity in high temperature superconductor (HTS) microwave and millimeter-wave devices. The HTS nonlinear model is based on the Ginzburg-Landau theory. The electromagnetic fields associated with the currents on the superconducting structure are obtained using a three-dimensional full wave solution of Maxwell's equations. A three-dimensional finite-difference time-domain algorithm simultaneously solves the resulting equations. The entire solution is performed in time domain, which is a must for this type of nonlinearity analysis. The macroscopic parameters of the HTS, the super fluid penetration depth and the normal fluid conductivity, are calculated as functions of the applied magnetic field. The nonlinear propagation characteristics for HTS transmission line, including the effective dielectric constant and the attenuation constant, are calculated. As the power on the transmission line increases, the phase velocity decreases and the line losses increase. The nonlinearity effects on the current distributions inside the HTS, the electromagnetic field distributions, and the frequency spectrum are also analyzed.

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