Abstracts

A Macroscopic Model of Nonlinear Constitutive Relations in Superconductors

J.J. Xia, J.A. Kong and R.T. Shin. "A Macroscopic Model of Nonlinear Constitutive Relations in Superconductors." 1994 Transactions on Microwave Theory and Techniques 42.10 (Oct. 1994 [T-MTT]): 1951-1957.

A macroscopic model is proposed for nonlinear electromagnetic phenomena in superconductors. Nonlinear constitutive relations are derived by modifying the linear London's equations. The superelectron number density as a function of applied macroscopic current density, n/sub s/(J), is derived from a distribution of electron velocities at a certain temperature T. At temperature T /spl ne/ 0 K, the function n/sub s/(J) has a smooth variation near the macroscopic critical current density J/sub c/. Agreement has been found between this n/sub s/(J,T) model and the temperature dependence of n/sub s/ in the two-fluid model. The nonlinear conductivities sigma/sub s/(J) and sigma/sub n/(J) are obtained from the London's equation with the modified n/sub s/(J) function. Nonlinear resistance R(I), kinetic inductance L/sub k/(I) and surface impedance Z/sub s/(I) in thin wire, slab, and strip geometries are calculated.

❑ Return to main document.