Abstracts

Full-Wave Analysis of Superconducting Microstrip Lines on Anisotropic Substrates Using Equivalent Surface Impedance Approach

L.H. Lee, W.G. Lyons, T.P. Orlando, S.M. Ali and R.S. Withers. "Full-Wave Analysis of Superconducting Microstrip Lines on Anisotropic Substrates Using Equivalent Surface Impedance Approach." 1993 Transactions on Microwave Theory and Techniques 41.11 (Dec. 1993 [T-MTT] (1993 Symposium Issue)): 2359-2367.

A computationally efficient full-wave technique is developed to analyze single and coupled superconducting microstrip lines on anisotropic substrates. The optic axis of the dielectric is in the plane of the substrate at an arbitrary angle with respect to the propagation direction. A dyadic Green's function for layered, anisotropic media is used to formulate an integral equation for the current in the strips. To increase the efficiency of the method, the superconducting strips are replaced by equivalent surface impedances which account for the loss and kinetic inductance of the superconductors. The validity of this equivalent surface impedance (ESI) approach is verified by comparing the calculated complex propagation constant and characteristic impedance for superconducting microstrip lines on an isotropic substrate to measured results, and to numerical results by the more rigorous volume-integral equation method. The results calculated using the ESI approach for perfectly conducting coupled lines on an anisotropic substrate agree with the results by the finite-difference time-domain method. This efficient ESI technique is then used to study the effects of the optic axis orientation and the strip width on the characteristics of single and coupled superconducting microstrip lines on M-plane sapphire. The effects of the line separation and operating temperature on the coupled lines are also investigated.

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