Abstracts

A Hybrid Method for the Calculation of the Resistance and Inductance of Transmission Lines with Arbitrary Cross Sections

M.J. Tsuk and J.A. Kong. "A Hybrid Method for the Calculation of the Resistance and Inductance of Transmission Lines with Arbitrary Cross Sections." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1338-1347.

The frequency-dependent resistance and inductance of uniform transmission lines are calculated with a hybrid technique that combines a cross-section coupled circuit method with a surface integral equation approach. The coupled circuit approach is most applicable for low-frequency calculations, while the integral equation approach is best for high frequencies. The low-frequency method consists in subdividing the cross section of each conductor into triangular filaments, each with an assumed uniform current distribution. The resistance and mutual inductance between the filaments are calculated, and a matrix is inverted to give the overall resistance and inductance of the conductors. The high-frequency method expresses the resistance and inductance of each conductor in terms of the current at the surface of that conductor and the derivative of that current normal to the surface. A coupled integral equation is then derived to relate these quantities through the diffusion equation inside the conductors and Laplace's equation outside. The method of moments with pulse basis functions is used to solve the integral equations. An interpolation between the results of these two methods gives very good results over the entire frequency range, even when few basis functions are used. Results for a variety of configurations are shown and are compared with experimental data and other numerical techniques.

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