Abstracts

A Finite-Difference Transmission Line Matrix Method Incorporating a Nonlinear Device Model

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This paper describes a variable-mesh combination of the expanded-node transmission line matrix (TLM) and finite-difference time-domain (FD-TD) methods for solving time-domain electromagnetic problems. It retains the physical process of wave propagation and the numerical stability of the former, and has the computational efficiency of the latter. This full-wave finite-difference transmission line matrix (FD-TLM) method utilizes transmission lines of differing impedances to implement a three-dimensional variable mesh which makes practical the simulation of structures having fine details, such as digital integrated circuits (IC's). Circuit models for lumped resistors, capacitors, diodes, and MESFET's have been developed and included for use in simulating digital and microwave IC's. The validity of the variable mesh implementation is verified by comparing an FD-TLM simulation of a picosecond pulse generator structure with electro-optical measurements, and the validity of the device model implementation is verified by comparing an FD-TLM simulation of a MESFET logic inverter with a SPICE simulation.

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