Abstracts

Accurate and Efficient Circuit Simulation with Lumped-Element FDTD Technique

A three-dimensional (3-D) implementation of the lumped-element finite-difference time-domain (FDTD) algorithm has been carried out. To accomplish proper description of device dynamic responses, the code incorporates accurate models of lumped bipolar devices, including nonlinear capacitances associated with pn and Schottky junctions. The nonlinear system arising from discretized lumped-element equations is solved by means of an iterative Newton-Raphson aigorithm, the convergence properties of which are sensitive to the value of the simulation time step. The computational efficiency of the algorithm (as well as its robustness) has significantly been enhanced by introducing an adaptive time-step algorithm, which dynamically adjusts the time-step itself to ensure convergence during the simulation. Several simulation examples are compared with conventional analysis techniques and demonstrate the algorithm reliability as well as its increased efficiency.

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