Abstracts

Transient electromagnetic analysis and model complexity reduction using the partial element equivalent circuit formulation

Nonlinear electromagnetic field simulation is becoming essential for mixed signal (RF/microwave and digital) circuit design applications. So far, direct analysis of such nonlinear electromagnetic circuits has been demonstrated successfully only within the context of the the FDTD and the TLM method. In this paper, it is shown that time-domain integral equation techniques can be used also for nonlinear electromagnetic circuit analysis. In particular, the application of the so-called Partial Element Equivalent Circuit formulation of the time-domain electric field integral equation leads to a very convenient SPICE-compatible approximation of the electromagnetic problem. Furthermore, it has the important attribute of lending itself to a very systematic and physical model complexity reduction on the basis of the electrical size of the various portions of the system under study. Numerical experiments are used to demonstrate these special attributes of this formulation.