Abstracts

Electromagnetic and semiconductor device simulation using interpolating wavelets

S. Goasguen, M.M. Tomeh and S.M. El-Ghazaly. "Electromagnetic and semiconductor device simulation using interpolating wavelets." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2258-2265.

A MESFET and a two-dimensional cavity enclosing a cylinder are simulated using a nonuniform mesh generated by an interpolating wavelet scheme. A self-adaptive mesh is implemented and controlled by the wavelet coefficient threshold. A fine mesh can therefore be used in domains where the unknown quantities are varying rapidly and a coarse mesh can be used where the unknowns are varying slowly. It is shown that good accuracy can be achieved while compressing the number of unknowns by 50% to 80% during the whole simulation. In the case of the MESFET, the I-V characteristics are obtained and the accuracy is compared with the basic finite difference scheme. A reduction of 83% in the number of discretization points at steady state is obtained with 3% error on the drain current. The performance of the scheme is investigated using different values of threshold and two types of interpolating wavelet, namely, the second-order and fourth-order wavelets. Due to the specific problem analyzed, a tradeoff appears between good compression, accuracy, and order of the wavelet. This represents the ongoing effort toward a numerical technique that uses wavelets to solve both Maxwell's equations and the semiconductor equations. Such a method is of great interest to deal with the multiscale problem that is the full-wave simulation of active microwave circuits.

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