Abstracts

SLIM: a slender technique for unbounded-field problems

S.E. Schwarz. "SLIM: a slender technique for unbounded-field problems." 1998 Transactions on Microwave Theory and Techniques 46.7 (Jul. 1998 [T-MTT]): 1022-1024.

Electrostatic- and electromagnetic-field problems in unbounded regions are often solved using finite differences (FD's) or finite elements (FE) combined with approximate boundary conditions. Inversion of the sparse FD or FE matrix is then required. First-order or higher order absorbing boundary conditions may be used, or one can use more accurate boundary conditions obtained by the measured equation of invariance (MEI) or by iteration. The more accurate boundary conditions are helpful because they permit reduction of the size of the mesh and, thus, the number of unknowns. In this paper, we show that the process can be carried to a maximally simple limit in which the mesh is reduced to a single layer and the matrix-inversion step disappears entirely. This results in the single-layer iterative method (SLIM), an unusually simple technique for unbounded-field problems. Computational experiments demonstrate the effectiveness of SLIM in electrostatics, and also in electrodynamic examples, such as scattering of TM plane waves from a perfectly conducting cylinder. The technique is most likely to be useful in large or complex problems where simplification is helpful, or in repetitive calculations such as scattering of radiation from many angles of incidence.

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