# Use of the Vector Finite Element Method for the Solution of Electromagnetic Problems

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The vector finite element method is formulated for the solution of time-harmonic Maxwell equations as applied to a wide range of electromagnetic problems including microwave circuits, high-frequency electronic packaging, scattering from various targets, and antenna radiation problems. A number of computational challenges often appear during the formulation of these problems ranging from proper excitation of the input/output ports to an accurate and effective truncation of the unbounded infinite space. A generalized eigenvalue problem is formulated at each of the ports in order to obtain the governing dispersive propagation characteristics and modes of the two-dimensional structure; these modal characteristics are subsequently used to properly excite/terminate the input and output ports of the three-dimensional structure. In the case of scattering or radiation problems, the unbounded infinite domain is properly truncated using first/second/higher-order absorbing boundary conditions, a perfectly matched layer, or an exact radiation condition based on a boundary-integral method. Numerical results on a number of practical engineering applications illustrate the power and effectiveness of the vector finite element method in solving complex electromagnetic problems.

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