Regularized Maxwell equations with nodal elements as an alternative approach to the edge-based FEM formulations

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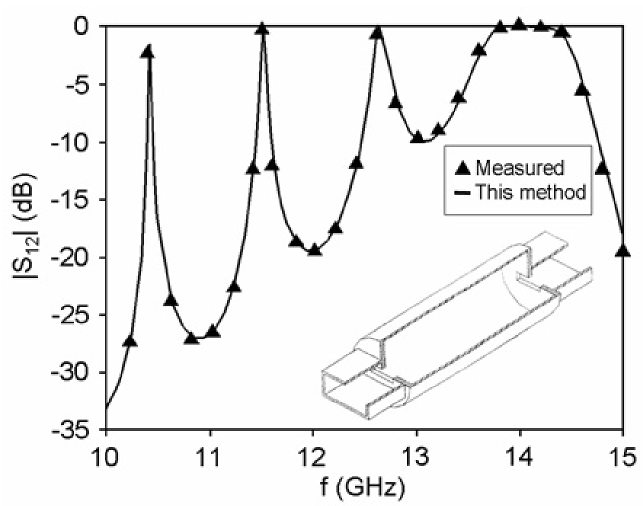
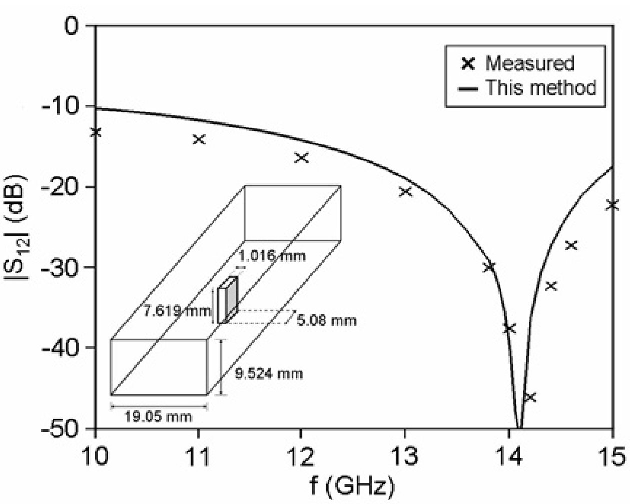
The aim of this work is to present an alternative approach to the usual finite element formulation based on edge elements and the double-curl Maxwell equations. This alternative approach is based on high-order nodal elements and the regularized Maxwell equations [1]. It provides spurious-free solutions and well-conditioned matrices. Only the three components of **E**, or **H**, are the unknowns, that is, there is no need of extra functions, like Lagrange multipliers or scalar potentials, to find a stable solution. The field discontinuities in the surfaces connecting different media are considered explicitly.

When the electromagnetic field has a singularity in the problem domain a globally wrong solution is obtained with the regularized formulation. To overcome this failure we make null the divergence term of the elements in contact with a singularity. For instance, in the next two examples were used 3rd order tetrahedral elements and the divergence term of the regularized weak formulation was made null in the elements in contact with the re-entrant edges. More examples will be shown to demonstrate the accuracy of the method.



Measured by J.R. Montejo-Garai and J. Zapata,
IEEE Trans Microwave Theory Tech 43 (1995), 1290-1297



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References

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