Abstracts

Efficient Singular Element for Finite Element Analysis of Quasi-TEM Transmission Lines and Waveguides with Sharp Metal Edges

J.M. Gil and J. Zapata. "Efficient Singular Element for Finite Element Analysis of Quasi-TEM Transmission Lines and Waveguides with Sharp Metal Edges." 1994 Transactions on Microwave Theory and Techniques 42.1 (Jan. 1994 [T-MTT]): 92-98.

The FEM presents a slow rate of convergence when it is used in the analysis of quasi-TEM transmission lines or homogeneous waveguides with field singularities. In order to improve this drawback, mesh techniques or vector elements that cope with the singularities can be used. A different solution is to employ scalar singular elements although, most of those that have been used are only compatible with first-order ordinary elements or can only be used with field singularities of order O(r/sup -1/2/) and O(r/sup -1/3/). In this paper, we present an improvement on the rate of convergence of FEM by employing a scalar singular element, which can be utilized for any order of singularity, is compatible with quadratic or higher order standard elements and is also easy to implement in standard finite element codes. Several transmission lines and waveguides with sharp metal edges have been analysed with a reduced number of degrees of freedom that compares well with other FEM approaches. We also show that electromagnetic fields computed using the proposed singular element have very good agreement with the ones theoretically expected from the singular edge condition.

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