One-way Equation Absorbing Boundaries and Analysis of Microstrip Via Holes, Patch Antennas and Meander Lines

(Channabasappa Eswarappa and Wolfgang J.R. Hoefer)

The absorbing boundary conditions based on one-way wave equations (formulated by Higdon for *FD-TD* analysis) have been investigated and implemented for the 3-D Symmetrical Condensed Node *TLM* analysis of dispersive microwave and millimeter-wave structures. Very low reflections over a wide frequency band have been obtained by concatenating two and three first-order boundary operators. Numerical stability of the absorbing boundary conditions with different discretizations of the boundary operators (derivatives) has been studied. It has been found that numerically stable algorithms can be obtained with proper discretizations. Also these absorbing boundaries have been extended to the variable mesh TLM. These excellent stable absorbing boundary conditions can considerably reduce the computational domain, thus making possible the *3-D TLM* analysis of planar and quasi-planar structures with moderate computer resources. The scattering parameters computed using these boundary conditions for microstrip via holes, microstrip patch antennas, microstrip meander lines, etc., compare well with the available data. The geometry and S-parameters of microstrip via hole are given in Fig. 1 and Fig. 2 below.

The details of this project are reported in the following papers:

[1] C. Eswarappa and W.J.R. Hoefer, “One-way equation absorbing boundary conditions for 3-D TLM analysis of planar and quasi-planar structures”, accepted for publication in IEEE Trans. on Microwave Theory Techniques.

[2] C. Eswarappa and W.J.R. Hoefer, “Absorbing boundaries for 3D-TLM modelling of microstrip patch antennas”, 23rd European Microwave Conference Proceedings, pp. 291-292, Palacio De Congresos, Madrid, Spain, Sept. 1993.

[3] C. Eswarappa and W.J.R. Hoefer, “Computation of S-parameters of a microstrip meander line on GaAs substrate using TLM method”, 10th Annual Review of Progress in Applied Computational Electromagnetics Digest, Monterey, CA, March 21-26, vol.1, pp. 94-100.

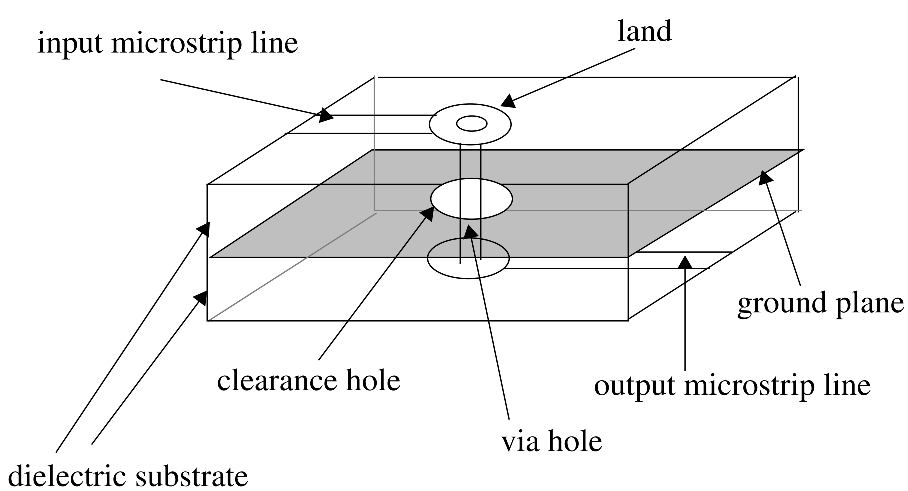

Fig. 1 Microstrip via hole geometry: width of the microstrip line = 3.3 mm, thickness of the substrate = 1.6 mm, diameter of the pad (land) = 3.9 mm, diameter of the clearance hole = 3.9 mm, diameter of the via hole = 1.5 mm, dielectric constant of the substrate.

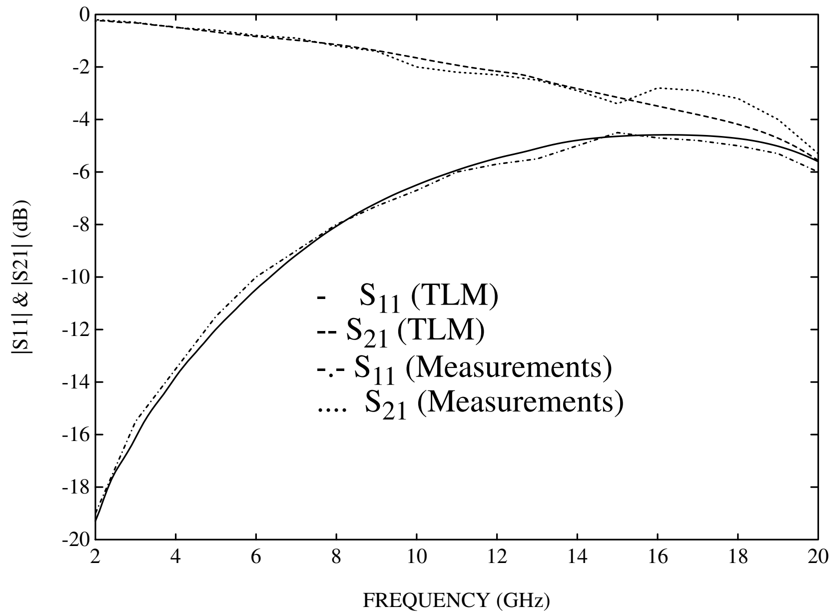

Fig. 2 The scattering parameters for the via hole.