

Network Analysis of Multiple Apertures on Cavity Enclosures with Wire Penetrations

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Increasing clock speeds and the need for compact electronic systems calls for Electromagnetic Interference and Compatibility (EMI/EMC) studies. In enclosures of electronic devices, there may be electromagnetic penetration and radiation through apertures such as ventilation slots, or interference among transmission lines. The goal is to cast the problem into a framework of network analysis, where individual structures involving apertures and wires are represented as macromodels generated from full-wave analysis. Macromodel generation requires multiple parameter sweep and efficient full-wave methods speed up the process.

We present an efficient solution for estimating coupling among arbitrarily shaped apertures on a rectangular metallic cavity (see Fig.1a). In our formulation, the fields across the apertures are approximated via the Method of Moments (MoM) using rooftop basis functions and Fig.1(b) shows the agreement with the measured data for a single aperture on a rectangular box. At the meeting, we will present approximate analysis for multiple apertures.

The presence of wires inside the cavity is treated through the field bouncing method. The interior field, expressed using modal Green's function, is first computed in the absence of wires. It is then used to illuminate the wires, and induced currents are computed using local approximations and the Transmission Line Theory. The currents are then reradiated into the cavity interior and the resulting total field is again interacted with the wires. The iteration continues until the steady state solution is reached.

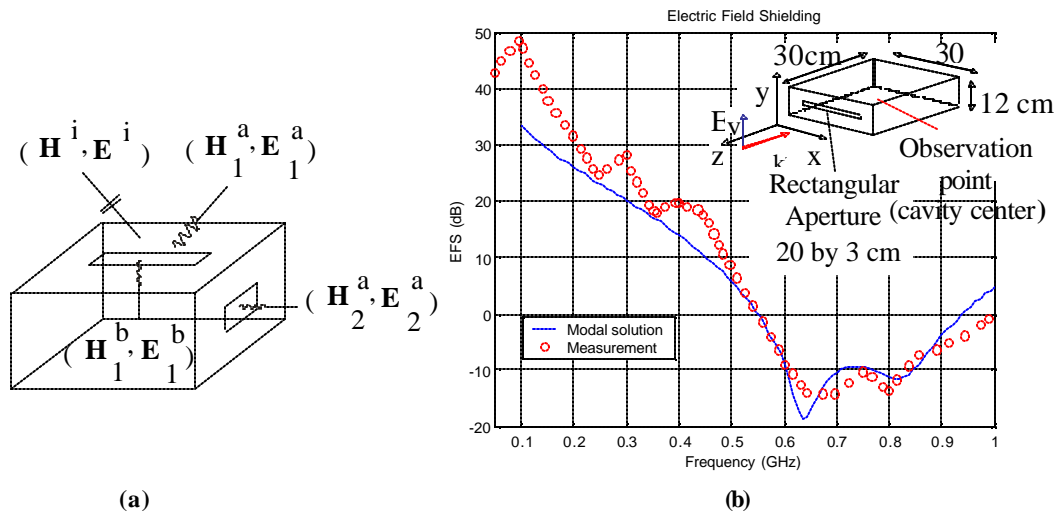


Fig. 1: (a) Multiple apertures on a rectangular metallic cavity, (b) Electric Field Shielding for single aperture case.