MULTI-RESOLUTION FINITE ELEMENT BOUNDARY INTEGRAL SIMULATION OF SHIELDING EFFECTIVENESS IN A SYMMETRIC TEM CELL

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Many electromagnetic problems today involve the propagation of waves at microwave or optical frequencies through single or multilayered composite structures. Composite materials are mainly used for spacecraft and aircraft structures for their light weight, high strength and ease of fabrication. Electromagnetic properties of composite materials are completely different in nature than those of simple metals and dielectrics. Accurate shielding effectiveness (SE) modeling of these materials is crucial for an effective design which complies with electromagnetic interference (EMI) and electromagnetic compatibility (EMC) requirements.

A conventional symmetric TEM cell consists of two symmetric sections coupled through an aperture. In this study, we present a multi-resolution hybrid Finite Element-Boundary Integral (FE-BI) method for modeling SE in a symmetric TEM Cell. We apply the hierarchical mixed-order tetrahedral tangential vector finite elements (TVFEs) given in [1] to obtain a computational model which accurately predicts the overall field behavior within the TEM cell. Since the properties of hierarchical TVFEs allow for the simultaneous use of low and higher order TVFEs within the same computational domain, we use higher order TVFEs only in regions associated with highly varying field intensities. The lowest order TVFEs are employed elsewhere to achieve an accurate and efficient field solution.

To validate the computational TVFE model, sample materials were placed on the aperture of the TEM cell, and SE was measured using a network analyzer (HP8753D). Comparative results regarding simulations and measurements will be presented.

[1] L. S. Anderson and J. L. Volakis, "*Hirerarchical tangential vector finite elements for tetrahedra,*" IEEE Microwave and Guided Wave Letters, vol. 8, pp. 127-129, March 1998.