COUPLING TO A LOADED THIN WIRE IN A CYLINDRICAL/COAXIAL CAVITY

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The electromagnetic field coupling to a loaded thin wire in a cylindrical/coaxial cavity is investigated. There is an interest in understanding how electromagnetic fields couple to wires and tubes that may be present in an enclosed structure and in how to efficiently analyze this coupling as part of an overall system. The cavity may consist of multiple cascaded coaxial and circular cylindrical sections with sections coupled through apertures and conducting elements common to more than one section. The sections may have different axial and radial dimensions and may be filled with material having different magnetic and electric properties. The technique for analyzing the field in these cavities with the wire absent was presented at the 2003 APS-URSI Symposium in Columbus, OH. A loaded thin wire protrudes into a cavity section and is placed in close enough proximity to the outer wall of the section that transmission line approximations are valid. The coupling of the cavity field to the wire is accounted for via a distributed voltage source model similar to that outlined by Agrawal, Price, and Gurbaxani (IEEE Trans. on Elect. Comp, May 1980) for a transmission line in open space or a wire parallel and close to a conducting surface. A coupled integral equation method was presented at the 2004 APS/URSI Conference in Monterey. The characteristic impedance of the wire in the presence of the cavity wall is developed. A Greens function for the current and voltage along a loaded transmission line due to a set of distributed voltage sources is developed and used to calculate the voltage and current at points along the wire. For the purpose of demonstrating the accuracy of the procedure and numerical solutions obtained from this analysis, a cavity model is constructed and measurements made on the laboratory model are compared with computed results. The measured voltage and current at a port on the wire is compared with values obtained computationally at the port. The computed results from this analysis are also compared with results from the coupled integral equation method.

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2. B - Fields and Waves

3. (a) EMI/EMC Modeling and Validation

4. C - Contributed Paper, Program chair: Danilo Erricolo

5. No special instructions