Electromagnetic Scattering from a Gap in a Magneto-Dielectric Coating on an Infinite Ground Plane

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The electromagnetic scattering from a gap in a magneto-dielectric coating on an infinite ground plane is analyzed. In this context, the gap forms a break only in the material slab coating while the ground plane is continuous and unbroken. The volume equivalence principle is used to convert the gap region to one containing unknown volumetric equivalent currents. The equivalent problem then is one of determining equivalent currents radiating in the presence of an unbroken grounded magneto-dielectric slab. A Green's function for this geometry is developed which consists of two terms: a direct coupling term and correction term to account for the multiple reflected wave series resulting from the grounded-slab geometry. The second term is formulated using periodic array theory and is derived using the Array Scanning Method (ASM). A set of coupled integral equations based on the equivalent currents is then solved via the Method of Moments (MoM) using point matching.

The model can represent a gap that is of a general two-dimensional (2D) shape and can be filled with an inhomogeneous material possessing isotropic magnetic and dielectric constitutive properties different from those of the slab coating. The properties of both the gap filler and the slab coating materials can be complex in representation of lossy materials. The scattering from the gap is evaluated for plane wave illumination that is either TM or TE polarized.

This hybrid Green's Function / MoM technique is validated using a general-purpose MoM reference code and measured data obtained on an RCS measurement range. The results show the hybrid method is accurate and more time efficient than methods relying on general-purpose codes.

New Knowledge: Extends ASM to application of surface feature scattering

Relation to previous work: ASM developed by Munk and Skinner for finite periodic array transmission, reflection, and scattering.

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