A Novel Method of Moments Technique to Analyze Scattering from Arbitrary Shaped Wire Structures in the Time-Domain

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Scattering problems from straight wires have been analyzed in the time-domain using Method of Moments (MoM) technique by utilizing piecewise sinusoidal basis functions (K. Sharma, K. Panayappan, C. Pelletti and R. Mittra, International Symposium on Antennas and Propagation and North American Radio Science Meeting, 130, 2015). However, when the wire scatterer has a bend or a junction, the scattered fields at a desired observation point cannot be obtained in the time-domain without using inverse Fourier transform even if piecewise sine basis function is used (Jordan E.C., Electromagnetic waves and radiating systems- 2nd Ed., Prentice-Hall, 1968).

In this paper, a novel Method of Moments technique is introduced where scattered fields from arbitrary shaped wire structures with bends or junctions are computed directly in the time-domain, thus allowing the MoM and Finite-Difference Time-Domain (FDTD) techniques to be combined directly in the time-domain. As a first step, a fictitious surface enclosing the arbitrary shaped wire object is assumed. The surface is discretized into quadrilateral patches. Scattered electric and magnetic fields from arbitrary shaped wire are then sampled at each patch on the fictitious surface for the desired frequency range. In the next step, equivalent electric and magnetic currents (J and M) are obtained at each patch of the surface for the desired frequency range using the surface equivalence principle. A modified rooftop basis function is assumed for each patch, and weight coefficients for J and M are computed over the desired frequency range for each patch utilizing the computed equivalent currents and basis function information. The scattering problem form arbitrary shaped wire becomes equivalent to scattering from a surface with modified rooftop basis function, where the scattered fields are obtained directly in the time-domain (K. Sharma and R. Mittra, International Symposium on Antennas and Propagation and National Radio Science Meeting, 27-28, 2016). The proposed technique is stable as compared to existing techniques for handling this type of problems.

Numerical results in terms of accuracy and efficiency will be discussed in the presentation.

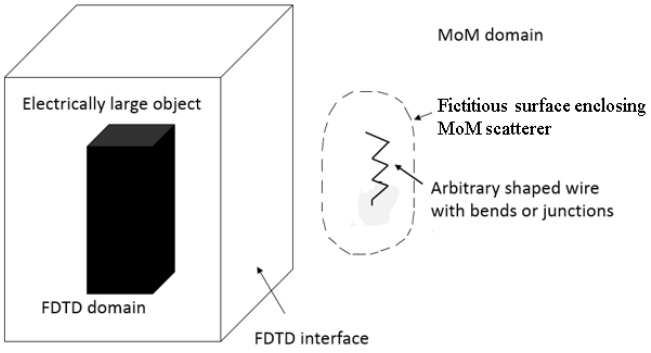

Figure 1. Arbitrary shaped wire scatterer in the MoM domain and electrically large scatterer in the FDTD domain.