On the Use of Spatio–Temporal Multiresolution Analysis in Method of Moments Solutions of Transient Electromagnetic Scattering

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***Abstract*—A novel method of moments approach to the solution of time-domain integral-equation formulation of electromagnetic scattering problems is presented. The method is based on a spatio–temporal multiresolution analysis. This analysis facilitates a basis from which a small number of expansion functions is selected via an iterative procedure and utilized to model the unknown current distribution. In contrast to marching-on-in-time sequential procedures, the proposed method models the unknown current simultaneously at all the time steps within the time frame of interest. This new method is applied to a one-dimensional (1-D) problem of electromagnetic plane wave interaction with a dielectric slab. A comparison of the computed results with results based on the analytic solution demonstrates that the method is capable of attaining accurate results while achieving substantial reduction in computation time and resources.**

passing through all the intermediate time steps until the desired time of interest is achieved.

In this paper, we present a novel method for solving the TDIE, which facilitates a stable and rather accurate solution simultaneously at all time steps within the time frame of interest. The new approach employs solution methods that make use of wavelet multiresolution bases [20], [21], which have already been successfully used for frequency-domain impedance matrix sparsification [22], [23] and compression [24], [25]. These bases seem to be adequate also for time-domain analysis, where an efficient expansion of both the spatial and temporal domains is essential [26], [27].

The wavelet-based solution of the TDIE is effected via a two-