Transient Higher Order Analysis of Composite Wire Structures Using Band Limited Extrapolation

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Widespread implementation of Time Domain Integral Equation (TDIE) based electromagnetic solvers has been hindered due of inefficiency and instability associated with the technique. The inefficiency associated with this technique can be alleviated by using accelerating techniques such as plane wave time domain and hierarchical fast Fourier transform (FFT). Recent work has also demonstrated a robust stable TDIE solver by using a new class of temporal basis functions (Weile *et al*, IEEE TAP, Vol 52).

This work will perform TDIE based transient analysis of composite wire structures. The modeled structures will contain wire-junctions of two or more wires. Conventional techniques used to model these structures use pulses as spatial basis functions to model junction currents. A particular basis function is associated with a pair of wire segments having a common node at the junction. The conservation of current at the junction ensures that the number of bases used to model junction currents is one less than the number of wires at the junction.

This work presented builds on this technique and uses higher order divergence conforming basis functions of Graglia *et al.* for spatial modeling of currents. These basis functions have been used successfully to perform higher order frequency-domain modeling of wire antennas (Mohan *et al*, URSI NRS meeting 2005). Apart from demonstrating the higher-order convergence, such a scheme also eliminates the restriction on the segment length-to-radius ratio imposed by the thin wire approximation. The temporal behavior of currents will be approximated by using Band Limited Interpolation Functions (BLIFs) proposed by Weile *et al.* Numerical results validating the stability and higher order behavior of the technique will be presented.