Solving Lumped Loading Problem in Time Domain Using EFIE and Laguerre Polynomials as Temporal Basis Functions

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The time-domain electric field integral equation (TD-EFIE) technique has been proven to be an effective and convenient tool for time domain analysis of various electromagnetic problems. The most popular method to solve a TD-EFIE is the marching-on-in-time (MOT) scheme. However, as pointed out by many researchers, the time-marching method may suffer from its late-time instability. Much work has been done to eliminate the instability. Recently, a new method called the marching-on-in-order method has been proposed for the solution of the TD-EFIE. The integral equation is solved by expressing the transient behaviors in terms of the Laguerre polynomials. By using these orthogonal basis functions for the temporal variation, the time derivatives can be handled analytically and the temporal variables can be completely eliminated from the final equations. Therefore stable results can be obtained even for late time. In this paper, the lumped loading problem in the scattering or radiation of conducting body is solved based on this method. The lumped loading can be combined into the triangle patch modeling. The integral and derivative of transient current of the loading can be obtained analytically using the Laguerre Polynomials. By spatial, temporal testing procedure and solving linear equations, the transient current can be obtained. The scattering of a strip dipole connected to a resistor, an inductor and a capacitor is simulated, respectively. The results were compared to frequency results obtained from WIPL-D by inverse discrete Fourier Transform (IDFT). They agree very well.