A new high order algorithm with low computational complexity for electric field simulation

Abstract

Problem statement: This research reported on new approach to improve speed of simulation time for free space electric wave propagation from an antenna. The existing method, Finite-Difference Time-Domain (FDTD) have been proven to solve the problem accurately, however, one of the drawbacks of the method was it needs a long processing time to simulate problem. Research efforts to increase the speed of simulating the problem are needed. Approach: Our recent research had found a new method with lower complexity and can simulate the problem faster than the existing FDTD algorithm. The method was developed by implementing the second order accurate discretization technique. But the method, which was named as the High Speed Low order finite-difference timedomain, had lower accuracy than the existing one. In this study, we reported on our new finding which used the $O(h4)$ truncation error rather than $O(h2)$ in our previous method. Results: The result found that we managed to recover the error and the new method still had computational complexity lower than the finite-difference time-domain. Conclusion: In terms of computation time, the new method also proved to solve problem faster than the conventional FDTD scheme with 9.03-63.66% reduction in computation time and also faster than the HO-FDTD with 82.48-88.99% reduction in computation time. © 2010 Science Publications.