Fourth order approximation with complexity reduction approach for the solution of time domain Maxwell equations in free space

Abstract

Propagation of electromagnetic fields from an antenna in a free space can always be modelled by time domain Maxwell equations. The equations have been used since their creation by Maxwell. Finite difference time domain (FDTD) method has been used since 1966 to model the propagation of electromagnetic fields. Previously, we have developed a new version of FDTD method called HSLO-FDTD. The method has shown to solve a 1D free space wave propagation problem 67% faster than the conventional FDTD. The parallel version of the method is then extended to solve 2D free space wave propagation problem. It is found that the method is 85.2% faster than the parallel FDTD method. In this paper, we further extend the method using the combination of fourth order approximation with the complexity reduction approach. The method shows to be faster than the conventional FDTD to simulate the 2D free space wave propagation   problem.