ABSTRACT

Maxwell's equations represent govern the fundamental behavior of electromagnetic fields. Numerous efforts have been devoted to solve Maxwell’s equations theoretically and numerically in complex media, such as anisotropic media and dispersive media.

The Finite- Difference Time-Domain (FDTD) method is a powerful numerical technique for solving time-dependent Maxwell's curl equations in general media [1], [2]. The basic FDTD technique has been extended over the years to solve increasingly more complicated media and geometries. In particular, in the past few years, FDTD has been extended to accommodate non-diagonal constitutive tensors, but the work done so far has been limited to second-order accurate schemes in both time and space.

Our goal in this thesis is to derive and study extensions of FDTD to achieve a scheme with higher order of accuracy in space for the study of electromagnetic wave propagation in homogeneous and inhomogeneous anisotropic media. The objective of attaining high order FDTD method is to reduce the overall truncation error and dispersion error of the finite-difference approximations, and increase the overall accuracy of the numerical results.