Numerical solution of time-dependent Maxwell's equations for modeling light scattering in human eye's structures

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In this work we discuss the numerical discretization of the time-dependent Maxwell's equations using a leap-frog type discontinuous Galerkin method. We focus on deriving stability and convergent estimates of fully discrete schemes. We consider anisotropic permittivity tensors, which arise naturally in our application of interest. An important aspect in computational electromagnetic problems is the implementation of the boundary conditions. We present some numerical examples to illustrate the theoretical results and also in the context of modeling scattered electromagnetic wave's propagation through human eye's structures. Finally, we also briefly discuss the multi-scale nature of the problem. In a small scale, we use Maxwell's equations to compute parameters that could be used as inputs to larger scale simulations namely using Monte Carlo methods.

Keywords: Maxwell's equations, fully explicit leap-frog discontinuous Galerkin method, stability, convergence, light scattering in the retina.

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