

## Finite Element Method for general three-dimensional time-harmonic Electromagnetic Problems of Optics.

We discuss a three-dimensional electromagnetic model for general geometries and materials. The model can be used for isolated scatterers and for configurations that are periodic with respect to one, two or three coordinates, for inhomogeneous as well as for anisotropic media. . Arbitrary time-harmonic current sources both outside and inside the scatterers are allowed.

Nedelec elements are applied to the variational formulation of the vector Helmholtz equation for either the electric or the magnetic field on a bounded computational volume. Around the volume a perfectly matched layer is applied to prevent unwanted reflections. The system is often huge (there may be 0.5 million double precision complex unknowns) so that an iterative solver is required. The preconditioning is a nontrivial problem. Presently incomplete LU with threshold and pivoting is applied. The amount of fill-in that is needed for convergence is considerable and approximately 90 % of CPU time is spent on the preconditioning.