



"Adaptive interface finite difference methods in light beam propagation computations"

Friday, April 18, 2:30 pm
Pickard Hall, Room 304

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Abstract:

In this talk, we shall consider light beam propagations in a spherical lens environment. For the situation we may assume that

$$\frac{1}{r}u_r(r, \phi, z) + u_{rr}(r, \phi, z) + \frac{1}{r}u_{\phi\phi}(r, \phi, z) - 2ik u_z(r, \phi, z) = 0$$

where u is the complex envelope involved, and z is the direction of the beam propagation. The above differential equation has been used frequently in modern light beam propagation computations.

In our investigations, the coefficient κ of the partial differential equation is discontinuous at the lens interfaces. For the sack of simplicity, in this talk, we will focus on the single surface case. The results to be discussed can be conveniently extended to multiple surface scenarios with additional discontinuities of the function κ introduced. Needless to say, such a discontinuity adds considerable difficulties to the computation of the numerical solution of the singular differential equation.

We will focus on the z -stretching adaptive finite difference method for computing paraxial light beam propagations through cylindrically symmetric domains. By introducing proper decomposed interface adaptive transformations, we will be able to solve the difference schemes developed on uniform mathematical grids for the solutions on nonuniform physical grids. Numerical stability will be ensured. Some interesting computational experiments will be presented.

The Math Department will provide refreshments 30 min. prior to the presentation.

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