1016-78-119 **Gadi Fibich** (fibich@post.tau.ac.il), School of Mathematical Sciences, Tel Aviv University, Ramat Aviv, 69978 Tal Aviv, Israel, and **Semyon Tsynkov*** (tsynkov@math.ncsu.edu), Department of Mathematics, Box 8205, North Carolina State University, Raleigh, NC 27695.
Numerical Solution of the Nonlinear Helmholtz Equation Using Nonorthogonal Expansions.

Previously, we have developed a fourth-order numerical method for solving the nonlinear Helmholtz equation that governs the propagation of electromagnetic waves in Kerr media. A key element of the algorithm was a new nonlocal artificial boundary condition. It has provided for the reflectionless propagation of the outgoing waves while also fully transmitting the given incoming beams at the boundaries of the computational domain. The method has enabled the direct simulation of nonlinear self-focusing in the nonparaxial regime, including quantitative prediction of backscattering. This capacity has not been achieved before in nonlinear optics.

In the latest version, we replace the transverse Dirichlet boundary conditions with the Sommerfeld-type local radiation boundary conditions constructed directly in the discrete framework. Their implementation requires evaluation of the eigenvalues and eigenvectors of a non-Hermitian matrix; the latter subsequently render the separation of variables in the framework of an iterative solver. In spite of the additional effort due to the expansion with respect to a nonorthogonal basis, the new algorithm offers considerable overall benefits, both from the standpoint of its numerical performance and the range of physical phenomena it can simulate. (Received February 07, 2006)