

ABSTRACT

GEOMETRIC INTEGRATORS FOR COUPLED NONLINEAR SCHRÖDINGER EQUATION

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Multisymplectic integrators like Preissman and six-point schemes and a semi-explicit symplectic method are applied to the coupled nonlinear Schrödinger equations (CNLSE). Energy, momentum and additional conserved quantities are preserved by the multisymplectic integrators, which are shown using modified equations. The multisymplectic schemes are backward stable and non-dissipative. A semi-explicit method which is symplectic in the space variable and based on linear-nonlinear, even-odd splitting in time is derived. These methods are applied to the CNLSE with plane wave and soliton solutions for various combinations of the parameters of the equation. The numerical results confirm the excellent long time behavior of the conserved quantities and preservation of the shape of the soliton solutions in space and time.

Keywords: nonlinear Schrödinger equation, coupled nonlinear Schrödinger equation, symplectic integrators, multisymplectic integrators, dispersion analysis, backward error analysis, modified equations, plane wave solution, soliton solution.