Document Type : Thesis

Document Title : *Numerical treatment of non-lenear schrondinger equation*

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Document Language : Arabic

Abstract : The aim of the project is to solve numerically the nonlinear cubic Schrodinger equa.tion using finite difference method. So, in Chapter 1 we study, in details, the finite difference method for solving parabolic equation in one dimension space; we present methods such as explicit methods, implicit methods and three time level schemes; we study the properties of each scheme such as accuracy, consistency, stability and convergence. In Chapter 2 we present the cubic Nonlinear Schrodinger equation and give the exact solution; also we study the properties of this equation and we show that the equation conserves energy and admits soliton solution; so we solve this equation numerically by using Crank-Nicolson method. Numerical results show that the energy is conserved exactly in the ca.se of one soliton and two solitons. The accura.cy of the resulting scheme is second order in space and in time and is unconditionally stable. Also we use Predictor-Corrector method for solving the nonlinear system and give numerical results. In Chapter 3 we present another method for solving the cubic nonlinear Schrondinger equation using Douglas idea \vith implicit midpoint rule; we get a scheme which is fourth order in space and second order in time. We use Ne\vtons method for solving the nonlinear system, and we show that the resulting scheme conserves energy. Also, in this chapter we solve the resulting scheme using new predictor corrector method, and this method gives us a very good result with little effort; we check this method numerically on a single soliton and two solitons; we found that the scheme conserves energy and unconditionally stable. Lastly we solve the nonlinear Schrodinger equation using Dirichlet boundary conditions. We give some numerical exa.mples to show that the method works well

Publishing Year : 1997 AH