Adaptive Wavelet Methods for Nonlinear Schrodinger Equations and the Time Dependent GL Equations

***Jun ZHOU[1,2], Youhe ZHOU[1,2]**

[1]Key Laboratory of Mechanics on Disaster and Environment in Western China, Ministry of Education of China, Lanzhou University, Gansu 730000, P.R. China.
[2]College of Civil Engineering and Mechanics, Lanzhou University, Gansu 730000, P.R. China.

*Corresponding author: zhoujun@lzu.edu.cn

Based on the interpolating scaling functions, a multiscale wavelet approximation for solutions of nonlinear Schrodinger equations (NLSE) and the time dependent GL equations is proposed, which has interpolation property, i.e. the wavelet coefficients are explicitly the function evaluations at the grid points on the coarsest scale. Further, by using the multiscale wavelet approximation (MWA), adaptive wavelet methods, including an adaptive wavelet-Galerkin method (AWGM) and an adaptive wavelet-collocation method (AWCM), are established to solve the nonlinear Schrodinger Equations and the time dependent GL (TDGL) equations, which are the two kinds of most important PDEs concerning many physics problems. As illustrative examples, the proposed AWGM and AWCM are tested on typical nonlinear Schrodinger equations and TDGL equations, respectively. And the results show the proposed AWGM and AWCM both achieve high accuracy and computation efficiency.

Keywords: Adaptive wavelet method, Interpolating scaling function, Nonlinear Schrodinger equation, Time dependent GL equation, Multiscale wavelet approximation.