

Accepted Manuscript

On partially inexact HSS iteration methods for the complex symmetric linear systems in space fractional CNLS equations

Yu-Hong Ran, Jun-Gang Wang, Dong-Ling Wang

PII: S0377-0427(16)30572-6

DOI: <http://dx.doi.org/10.1016/j.cam.2016.11.030>

Reference: CAM 10903

To appear in: *Journal of Computational and Applied Mathematics*

Received date: 23 May 2015

Revised date: 18 June 2016

Please cite this article as: Y.-H. Ran, J.-G. Wang, D.-L. Wang, On partially inexact HSS iteration methods for the complex symmetric linear systems in space fractional CNLS equations, *Journal of Computational and Applied Mathematics* (2016), <http://dx.doi.org/10.1016/j.cam.2016.11.030>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



On partially inexact HSS iteration methods for the complex symmetric linear systems in space fractional CNLS equations

Yu-Hong Ran*, Jun-Gang Wang[†] and Dong-Ling Wang[‡]

^{*,‡}*Center for Nonlinear Studies, School of Mathematics, Northwest University, Xi'an, Shaanxi 710127, China*

[†]*Department of Applied Mathematics, Northwestern Polytechnical University, Xi'an, Shaanxi 710072, China*

Abstract

The space fractional coupled nonlinear Schrödinger (CNLS) equations are discretized by an implicit conservative difference scheme with the fractional centered difference formula, which is unconditionally stable. The coefficient matrix of the discretized linear system is equal to the sum of a complex scaled identity matrix and a symmetric positive definite diagonal-plus-Toeplitz matrix. The Hermitian and skew-Hermitian splitting (HSS) method and the partially inexact HSS (PIHSS) method are employed to solve the discretized linear system. In the inner iteration processes of the HSS method, we only need to solve the linear sub-systems associated with the Hermitian part inexactly by the conjugate gradient (CG) method, resulting in PIHSS iteration method. Theoretical analyses show that both HSS and PIHSS methods are unconditionally convergent. Numerical examples are given to demonstrate the effectiveness of the HSS iteration and the PIHSS iteration.

Keywords: The space fractional Schrödinger equations; Hermitian and skew-Hermitian splitting; Inexact iterations; Conjugate gradient method; Convergence analysis

1 Introduction

In this paper, we consider the space fractional coupled nonlinear Schrödinger (CNLS) equations

$$\begin{cases} iu_t + \gamma(-\Delta)^{\frac{\alpha}{2}}u + \rho(|u|^2 + \beta|v|^2)u = 0, \\ iv_t + \gamma(-\Delta)^{\frac{\alpha}{2}}v + \rho(|v|^2 + \beta|u|^2)v = 0, \end{cases} \quad a \leq x \leq b, \quad 0 < t \leq T, \quad (1.1)$$

with the initial boundary value conditions

$$\begin{cases} u(x, 0) = u_0(x), & v(x, 0) = v_0(x), & a \leq x \leq b, \\ u(a, t) = u(b, t) = 0, & v(a, t) = v(b, t) = 0, & 0 \leq t \leq T, \end{cases}$$

*Corresponding author. E-mail address: ranyh@nwnu.edu.cn (Y.-H. Ran).

[†]E-mail address: modiker@163.com (J.-G. Wang).

[‡]E-mail address: wdyxtu@126.com (D.-L. Wang).

Download English Version:

<https://daneshyari.com/en/article/5776325>

Download Persian Version:

<https://daneshyari.com/article/5776325>

[Daneshyari.com](https://daneshyari.com)