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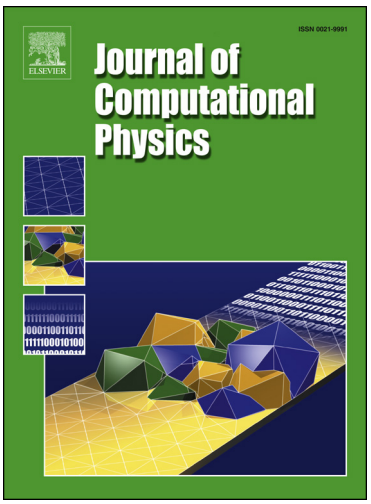

Computing a numerical solution of two dimensional non-linear Schrödinger equation on complexly shaped domains by RBF based differential quadrature method

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Computing a numerical solution of two dimensional non-linear Schrödinger equation on complexly shaped domains by RBF based differential quadrature method

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Abstract

In this paper, two-dimensional Schrödinger equations are solved by differential quadrature method. Key point in this method is the determination of the weight coefficients for approximation of spatial derivatives. Multiquadric (MQ) radial basis function is applied as test functions to compute these weight coefficients. Unlike traditional DQ methods, which were originally defined on meshes of node points, the RBFDQ method requires no mesh-connectivity information and allows straightforward implementation in an unstructured nodes. Moreover, the calculation of coefficients using MQ function includes a shape parameter c. A new variable shape parameter is introduced and its effect on the accuracy and stability of the method is studied. We perform an analysis for the dispersion error and different internal parameters of the algorithm are studied in order to examine the behaviar of this error. Numerical examples show that MQDQ method can efficiently approximate problems in complexly shaped domains.

Keywords: Schrödinger equation, differential quadrature method, radial basis function, variable shape parameter, dispersion error.

1 Introduction

The two dimensional Schrödinger equation arises in countless applications [1–3] and the ability to predict accurate solutions to this kind equation is the fundamental importance

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