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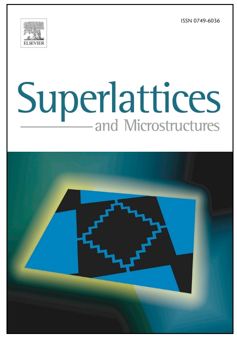

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Lie symmetry analysis, conservation laws, solitary and periodic waves for a coupled Burger equation *

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Abstract: Under investigation in this paper is a generalized (2+1)-dimensional coupled Burger equation with variable coefficients, which describes lots of nonlinear physical phenomena in geophysical fluid dynamics, condense matter physics and lattice dynamics. By employing the Lie group method, the symmetry reductions and exact explicit solutions are obtained, respectively. Based on a direct method, the conservations laws of the equation are also derived. Furthermore, by virtue of the Painlevé analysis, we successfully obtain the integrable condition on the variable coefficients, which plays an important role in further studying the integrability of the equation. Finally, its auto-Bäcklund transformation as well as some new analytic solutions including solitary and periodic waves are also presented via algebraic and differential manipulation.

Keywords: a coupled Burger equation; Lie group method; conservation laws; Painlevé analysis; auto-Bäcklund transformation; Solitary and periodic waves.

(Some figures in this article are in colour only in the electronic version)

1. Introduction

It is well known that nonlinear evolution equations(NLEEs) can exhibit a vast variety of nonlinear phenomena, such as geophysical fluid dynamics, ino-acoustic waves, the jams in congested traffic, condense matter physics, lattice dynamics, etc. In the past decades, noticeable progress in this field have led to powerful methods to deal with the PDEs, such as the inverse scattering transformation [1], symmetry approach [2, 3, 4], Darboux and Bäcklund transformation [5, 6, 7], Hirota's bilinear method [8], Painlevé analysis [9, 10], etc. Painlevé analysis is a powerful and successful approach, which plays an significant role in testing the integrability and exploring the integrable conditions of given NLEEs by analysing the singularity structure of the solutions. Once a given NLEE passes the Painlevé test, auto-Bäcklund transformation and various analytic solutions can be naturally and successfully constructed based on the integrable condition. Meanwhile, the Lie symmetry analysis is also a widely applied method in integrable systems and soliton theory. For a given system, many important applications can be achieved from one known symmetry, such as obtaining the different types of group-invariant solutions and exact analytic solutions by finding the symmetry reductions. In addition, more and more studies have been devoted to the Lie group method [11]-[21].

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