Author's personal copy

Nonlinear Dyn
https://doi.org/10.1007/s11071-019-05294-x

ORIGINAL PAPER

Lie symmetry reductions and group invariant solutions of (2+1)-dimensional modified Veronese web equation

Sachin Kumar · **Amit Kumar**

Received: 27 July 2019 / Accepted: 3 October 2019
© Springer Nature B.V. 2019

Abstract The Lie symmetry method is successfully applied to compute group invariant solutions for (2+1)-dimensional modified Veronese web equation. The purpose of this present article is to study the modified Veronese web (*mVw*) equation and to obtain its infinitesimals, commutation table of Lie algebra, symmetry reductions and closed form analytical solutions. The obtained results are explicitly in the form of the functions $f_1(y)$, $f_2(t)$, $f_3(x)$ and $f_4(x)$ and hold numerous solitary wave solutions that are more helpful to describe dynamical phenomena through their evolution profile. The solutions are analysed physically via numerical simulation. Consequently, elastic behaviour multisolitons, line soliton, doubly soliton, parabolic wave profile, nonlinear behaviour of wave profile and elastic interaction soliton profile of solutions are demonstrated in the analysis and discussion section to make this study more praiseworthy.

Keywords Group invariant solutions · (2+1)-dimensional *mVw* equation · Lie symmetry method

S. Kumar (✉)
Department of Mathematics, Faculty of Mathematical Sciences, University of Delhi, Delhi 110007, India
e-mail: sachinambariya@gmail.com

A. Kumar
Department of Mathematics, Sri Venkateswara College, University of Delhi, Delhi 110021, India
e-mail: amitk@svc.ac.in

1 Introduction

The complex physical phenomena in real life could be described by nonlinear partial differential equations (NPDEs). Basically, these NPDEs can be associated in nonlinear optics, condensed matter physics, plasma physics, fluid dynamics and other related fields [1,2]. In our present work, we generate closed form analytical solutions of (2+1)-dimensional modified Veronese web (*mVw*) equation. Closed form solutions have direct application in describing the dynamical behaviour of the equation associated with PDE. Additionally, it is most important to cast some brief perspectives about solitons.

In soliton theory, solitons or soliton signals are developed due to the nonlinear, dispersive and diffusive results, whereas a soliton is also known as solitary wave that behave like a bunches of particles. It maintains particular shapes, velocity and amplitude with the impact of others solitons [3–5]. Several NPDEs can be formulated on the basis of soliton wave or soliton signals.

The main objective of this study is to introduce Lie symmetry method to obtain group invariant solutions of (2+1)-dimensional modified Veronese web (*mVw*) equation

$$u_{ty} - u_t u_{xy} + u_y u_{tx} = 0, \tag{1}$$

where the variables x and y are applied here for space and t is temporal. The *mVw* equation described by [6]

Published online: 28 October 2019