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Classical symmetries, travelling wave solutions and conservation laws of a Generalized Fornberg-Whitham equation

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Abstract

In this paper we consider a generalized Fornberg-Whitham Equation. We make an analysis of the symmetries of this equation by using the classical Lie symmetry method. Symmetry reductions are derived from an optimal system of subalgebras and lead to ordinary differential equations. We obtain travelling wave solutions. In addition, by using the general multiplier method, new conservation laws of this equation are determined.

Keywords: partial differential equations, symmetries, conservation laws

1. Introduction

Nonlinear partial differential equations widely describe complex mechanical and physical phenomenon. So it is of great importance to obtain exact solutions of nonlinear partial differential equations (PDEs), in particular travelling wave solutions are among the interesting types of solutions for the nonlinear PDEs. On the other hand, many nonlinear partial differential equations, as Korteweg-de Vries or Camassa-Holm equations, have been found to possess a variety of travelling wave solutions. These are model equations for the unidirectional nonlinear dispersive waves in shallow water.

The Fornberg-Whitham equation which is given as

$$u_t - u_{xxt} + u_x = uu_{xxx} - uu_x + 3u_x u_{xx}$$

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