

New exact solutions for a generalised Burgers-Fisher equation

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Abstract

New travelling wave solutions for a generalised Burgers-Fisher (GBF) equation are obtained. They arise from the solutions of nonlinear second-order equations that can be linearised by a generalised Sundman transformation. The reconstruction problem involves a one-parameter family of first-order equations of Chini type. Firstly we obtain a unified expression of a one-parameter family of exact solutions, few of which have been reported in the recent literature by using hitherto not interrelated procedures, such as the tanh method, the modified tanh-coth method, the Exp-function method, the first integral method, or the improved expansion method. Upon certain condition on the coefficients of the GBF equation, the procedure succeeds in finding all the possible travelling wave solutions, given through a single expression depending on two arbitrary parameters, and expressed in terms of the Lerch Transcendent function. Finally, the case is completely solved, classifying all the admitted travelling wave solutions into either a one-parameter family of exponential solutions, or into a two-parameter family of solutions that involve Bessel functions and modified Bessel functions. For particular subclasses of the GBF equation new families of solutions, depending on one or two arbitrary parameters and given in terms of the exponential, trigonometric, and hyperbolic functions, are also reported.

Keywords

Generalised sundman transformation, λ -Symmetries, Generalised, Burgers-Fisher equations, Travelling wave solutions