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Peakon solutions of a *b*-Novikov equation

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ABSTRACT
The homotopy analysis method is applied to a *b*-Novikov equation in order to obtain analytic approximations of its peakon solution for various values of *b*. The results demonstrate that there is an excellent agreement between the approximate solution and the known exact peakon solution of the equation. Moreover, the amplitude of the peakon is approximated and a conservation property of the obtained solution is validated.

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1. Introduction

A considerable amount of work has been devoted to finding and studying travelling wave solutions of nonlinear partial differential equations (PDEs), including solitons and peakons. In this paper, analytic approximations of the peakon solution of the *b*-Novikov equation

$$u_t - u_{xxt} = u^2 u_{xxx} + b u u_x u_{xx} - (b+1) u^2 u_x, \quad u = u(x,t), \tag{1}$$

will be determined for various integer values of $b \geq 2$. Equation (1) generalizes the well-known Novikov equation

$$u_t - u_{xxt} = u^2 u_{xxx} + 3 u u_x u_{xx} - 4 u^2 u_x, \quad u = u(x,t), \tag{2}$$

which is deduced from (1) for $b = 3$. At the same time, Equation (1) is a special case (for $k = 2$) of the generalized Camassa-Holm (g-kbCH) equation

$$u_t - u_{xxt} = u^k u_{xxx} + b u^{k-1} u_x u_{xx} - (b+1) u^k u_x, \quad u = u(x,t), \tag{3}$$

which was studied in [1], as well as (for $p = 2$, $C = 1$, $A = b+1$) of the four parameter equation

$$u_t - u_{xxt} + A u^p u_x - b u^{p-1} u_x u_{xx} - C u^p u_{xxx} = 0, \quad u = u(x,t), \tag{4}$$

studied in [2].

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