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Review

Comment on: The (G′/G)-expansion method for the nonlinear lattice equations [Commun Nonlinear Sci Numer Simulat 17 (2012) 3490–3498]

İsmail Aslan

Department of Mathematics, Izmir Institute of Technology, Urla, Izmir 35430, Turkey

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ABSTRACT

We show that two of the nonlinear lattice equations studied by Ayhan & Bekir [Commun Nonlinear Sci Numer Simulat 17 (2012) 3490–3498] have already been investigated by Aslan [Commun Nonlinear Sci Numer Simulat 15 (2010) 1967–1973] using an improved version of the same method. The solutions obtained by the latter one include the solutions obtained by the former one.

Contents

Recently, Ayhan & Bekir [1] studied the two nonlinear lattice equations

$$\frac{du_n(t)}{dt} = (1 + \alpha u_n - \beta u_n^2)(u_{n+1} - u_{n-1}), \tag{1}$$

$$\frac{du_n(t)}{dt} = (\alpha - u_n^2)(u_{n+1} - u_{n-1}), \tag{2}$$

by means of the basic (G′/G)-expansion method [2] which is based on the assumption that the solutions of the reduced equation (via the wave transformation) can be expressed in the form

$$\mathbf{U_n}(\xi_\mathbf{n}) = \sum_{l=-m}^{m} a_l \left(\frac{G'(\xi_\mathbf{n})}{G(\xi_\mathbf{n})}\right)^l, \quad G''(\xi_\mathbf{n}) + \mu G(\xi_\mathbf{n}) = 0, \tag{3}$$

where all involved constants are determined at the stage of solving the problem.

On the other hand, Aslan [3] analyzed the nonlinear lattice equation

$$\frac{du_n(t)}{dt} = (a + bu_n + cu_n^2)(u_{n-1} - u_{n+1}), \tag{4}$$

E-mail address: ismailaslan@iyte.edu.tr

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by an improved version of the basic (G′/G)-expansion method (also known as the simplest equation method [4]) which is based on the assumption that the solutions of the reduced equation (via the wave transformation) can be expressed in the form

$$\mathbf{U_n}(\xi_\mathbf{n}) = \sum_{l=-m}^{m} a_l \left(\frac{G'(\xi_\mathbf{n})}{G(\xi_\mathbf{n})}\right)^l, \quad G''(\xi_\mathbf{n}) + \mu G(\xi_\mathbf{n}) = 0, \tag{5}$$

where all involved constants are determined at the stage of solving the problem.

Now, we make the following observations:

(i) Eqs. (1) and (2) are special cases of Eq. (4). Namely, taking $a = \alpha$, $b = -\alpha$, and $c = \beta$ in Eq. (4) leads to Eq. (1); taking $a = -\alpha$, $b = 0$, and $c = 1$ in Eq. (4) leads to Eq. (2). Hence, Eq. (4) includes both Eq. (1) and Eq. (2).

(ii) The basic (G′/G)-expansion method uses the auxiliary equation $G'' + \lambda G' + \mu G = 0$ where λ and μ are arbitrary constants. Recently, Aslan [5] demonstrated the redundancy of the parameter λ. In other words, one can make the assumption $\lambda = 0$ without loss of generality. This approach reduces the number of the parameters at the outset without affecting the generality of the results. Also, it should be clear that (5) is a further generalization of (3) in the meaning that the sum goes from $l = -m$ to $l = m$ instead of from $l = 0$ to $l = m$ where m is a positive integer. This fact indicates that the solutions obtained by (5) include the solutions obtained by (3).

(iii) It is also worth to mention here that the so-called two-component Volterra lattice equations

$$\begin{cases} \frac{du_n}{dt} = u_n(v_n - v_{n-1}), \\ \frac{dv_n}{dt} = v_n(u_{n+1} - u_n), \end{cases} \tag{6}$$

considered by Ayhan & Bekir [1] as a third equation was studied by Aslan [6] by means of (5) above.

Conclusion

We observed that Ayhan & Bekir [1] does not make a reference to Aslan's works [3,6]. It seems that the work [1] contains a lot of unnecessary references which served as the impetus for the publication of the authors' work. In addition, it should be pointed out that the references [7,8] contain some useful information about the application of the basic (G′/G)-expansion method. As a final remark, we believe that Ayhan & Bekir [1] restudied three nonlinear lattice equations which have already been studied by Aslan [3,6] using an improved version of the same method.

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