Hindawi Publishing Corporation
Abstract and Applied Analysis
Volume 2013, Article ID 720640, 2 pages
http://dx.doi.org/10.1155/2013/720640

Letter to the Editor

Comment on "A New Second-Order Iteration Method for Solving Nonlinear Equations"

Haibin Li

School of Mechanical, College of Science, Inner Mongolia University of Technology, Hohhot 010051, China

Correspondence should be addressed to Haibin Li; lhbnm2002@163.com

Received 21 May 2013; Accepted 1 September 2013

Academic Editor: Allan Peterson

Kang et al. claimed that they obtained a new iteration formulation for nonlinear algebraic equations; however the "new" formulation was first derived in 2007 by the variational iteration method.

Recently Kang et al. studied the following algebraic equation:

$$x = g(x) \tag{1}$$

and obtained the following iteration formulation [1, Equation (13)]:

$$x_{n+1} = \frac{-x_n g'(x_n) + g(x_n)}{1 - g'(x_n)}, \quad g'(x_n) \neq 1. \tag{2}$$

Kang et al. claimed that this was a new iteration formulation [1]; however, a more general iteration formulation has appeared in 2007 [2].

Consider a nonlinear algebraic equation

$$f(x) = 0. \tag{3}$$

By the variational iteration method [2], the following iteration formulation was obtained [2, Equation (7)]:

$$\begin{gathered} x_{n+1} = x_n - \frac{h(x_n) f(x_n)}{h(x_n) f'(x_n) + h'(x_n) f(x_n)}, \\ h(x_n) f'(x_n) + h'(x_n) f(x_n) \neq 0, \end{gathered} \tag{4}$$

where $h(x)$ is an auxiliary function.

Choosing $h(x) = 1$ and $f(x) = x - g(x)$ in (4), we have

$$x_{n+1} = x_n - \frac{x_n - g(x_n)}{1 - g'(x_n)} = \frac{-x_n g'(x_n) + g(x_n)}{1 - g'(x_n)}. \tag{5}$$

This is exactly (2).

Using the basic idea of the variational iteration method as illustrated in [2] (see (1)–(8) in [2]), we can construct an iteration formulation for (1) in the form

$$x_{n+1} = g(x_n) + \lambda \left(g(x_n) - x_n\right), \tag{6}$$

where λ is a Lagrange multiplier. To identify the multiplier, we set (see [2, Equation (4)])

$$\frac{dx_{n+1}}{dx_n} = g'(x_n) + \lambda \left(g'(x_n) - 1\right) = 0, \tag{7}$$

from which the multiplier can be identified, which is

$$\lambda = -\frac{g'(x_n)}{g'(x_n) - 1}. \tag{8}$$

This results in

$$\begin{aligned} x_{n+1} &= g(x_n) - \frac{g'(x_n)}{g'(x_n) - 1}\left(g(x_n) - x_n\right) \\ &= \frac{-g(x_n) + x_n g'(x_n)}{g'(x_n) - 1}. \end{aligned} \tag{9}$$

Remark 1. Equation (9) is exactly (2) or (4) when $h(x) = 1$ and $f(x) = x - g(x)$.

Remark 2. Equation (7) is exactly equivalent to $g'_\theta(x) = 0$ in [1].

Remark 3. θ in [1] is exactly equivalent to the Lagrange multiplier in (7).

Remark 4. The derivation process is the same as that given in [2].

It can be concluded that the so-called new iteration method is a special case of He 2007 formulation; various modifications of Newton iteration formulations are available in [2–7].

References

[1] S. M. Kang, A. Rafiq, and Y. C. Kwun, "A new second-order iteration method for solving nonlinear equations," *Abstract and Applied Analysis*, vol. 2013, Article ID 487062, 4 pages, 2013.

[2] J. H. He, "Variational iteration method-Some recent results and new interpretations," *Journal of Computational and Applied Mathematics*, vol. 207, no. 1, pp. 3–17, 2007.

[3] J.-H. He, Y.-Q. Wan, and Q. Guo, "An iteration formulation for normalized diode characteristics," *International Journal of Circuit Theory and Applications*, vol. 32, no. 6, pp. 629–632, 2004.

[4] J.-H. He, "A new iteration method for solving algebraic equations," *Applied Mathematics and Computation*, vol. 135, no. 1, pp. 81–84, 2003.

[5] X.-G. Luo, "A note on the new iteration method for solving algebraic equations," *Applied Mathematics and Computation*, vol. 171, no. 2, pp. 1177–1183, 2005.

[6] J.-H. He, "Some asymptotic methods for strongly nonlinear equations," *International Journal of Modern Physics B*, vol. 20, no. 10, pp. 1141–1199, 2006.

[7] J. H. He, "Asymptotic methods for solitary solutions and compactons," *Abstract and Applied Analysis*, vol. 2012, Article ID 916793, 130 pages, 2012.