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SOLITON SOLUTIONS OF GENERALIZED FISHER EQUATION AND SPALDING EQUATION BY HYPERBOLIC TANGENT FUNCTION METHOD

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Abstract

In this paper, the hyperbolic tangent function (tanh) method is used in finding soliton solutions of Generalized Fisher Equation (GFE) and Spalding Equation (SE). It is shown that the tanh method provides a straight forward and powerful tool for solving Nonlinear Evolution Equations (NLEEs) in Mathematical Physics.

Keywords and phrases: soliton, tanh method, Generalized Fisher Equation (GFE), Spalding Equation (SE), NLEEs.

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References

[1] M. J. Ablowitz and P. A. Clarkson, Solitons, Nonlinear Evolution Equations and Inverse Scattering Transform Method, Cambridge University Press, Cambridge, 1991.

[2] R. Hirota, Exact solution of the kdV equation for multiple collisions of solitons, Phys. Rev. Lett. 27 (1971), 1192-1194.

[3] M. R. Miura, Backlund Transformation, Springer-Verlag, 1978.

[4] M. Wadati, The exact solution of modified Korteweg-de Vries equation, J. Phys. Soc. Jap. 32 (1972), 1681-1687.

[5] N. A. Kudryasov, Exact solutions of generalized Kuramoto-Shivashinsky equation, Phys. Lett. A 147 (1990), 287-289.

[6] N. A. Kudryashov, On types of nonlinear non integrable equations with exact solutions, Phys. Lett. A 147 (1990), 287-291.

[7] S. Liu, Z. Fu, S. D. Liu and Q. Zhao, Jacobi elliptic function expansion method and periodic wave solutions of nonlinear wave equations, Phys. Lett. A 289 (2001), 69-74.

[8] W. Malfliet, Solitary wave solutions of nonlinear wave equations, Am. J. Phys. 60(7) (1992), 650-654.

[9] W. Malfliet and W. Hereman, The tanh method I: Exact solutions of nonlinear evolution equations and wave equations, Phys. Scr. 54 (1996), 563-568.

[10] W. Malfliet, Tanh method: A tool for solving certain classes of nonlinear evolution equations and wave equations, J. Comp. Appl. Math. 164-165 (2004), 529-541.

[11] A. M. Wazwaz, The tanh method for compact and noncompact solutions for variants of KdV-Burger equation, Phys. D: Nonlinear Phenomena 213(2) (2006), 147-151.

[12] E. Fan, Extended tanh function and its application to nonlinear equation, Phys. Lett. A 277(4-5) (2000), 212-218.

[13] A. M. Wazwaz, The extended tanh method for new soliton solutions for many forms of the fifth order KdV equations, Appl. Math. Comp. 184(2) (2007), 1002-1014.

[14] A. M. Wazwaz, The tanh-coth method for solitons and kink solutions for nonlinear parabolic equations, Appl. Math. Comp. 188 (2007), 1467-1475.

[15] S. A. El-Wakil and M. A. Abdou, New exact travelling wave solutions using modified extended tanh function method, Chaos, Solitons and Fractals 31(4) (2007), 840-852.

[16] J. Kim, A numerical method for the Cahn-Hilliard equation with a variable mobility, Comm. Nonlinear Sci. Numer. Simulat. 12 (2007), 1560-1571.

[17] J. H. He, A variational iteration method - A kind of nonlinear analytical technique: some examples, Int. J. Nonlinear Mech. 34(4) (1999), 699-708.

[18] J. H. He and X. H. Wu, Construction of solitary solution and compacton-like soliton solution by variational iteration method, Chaos, Solitons and Fractals 29 (2006), 108-113.

[19] G. Adomian, Solving Frontier Problems of Physics: the Decomposition Method, Kulwer Academic Publishers, Boston, 1994.

[20] S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, New York, 1993.

[21] X.-Y. Tang and S.-Y. Lous, Abundant coherent structures of the dispersive long-wave equation in $(2+1)$- dimensional spaces, Chaos, Solit. Fract. 14 (2002), 1451-1456.

[22] A. M. Wazwaz, A sine-cosine method for handling nonlinear wave equations, Math. Comp. Model. 40(5) (2004), 499-508.

[23] A. M. Wazwaz, The sine-cosine method for obtaining solutions with compact and non compact structures, Appl. Math. Comp. 159(2) (2004), 559-576.

[24] E. Fan and H. Zhang, A note on the homogeneous balance method, Phys. Lett. A 246 (1998), 403-406.

[25] J. H. He and X. H. Wu, Exp-function method for nonlinear wave equations, Chaos, Solitons and Fractals 30 (2006), 700-708.

[26] M. Y. Tang, R. Q. Wang and J. Z. Jing, Solitary waves and the bifurcations of KdV like equations with higher order nonlinearity, Sci. China Ser. A 45 (2002), 1255-1267.

[27] J. H. He, Application of homotopy perturbation method to nonlinear wave equations, Chaos, Solitons and Fractals 26 (2005), 695-700.

[28] R. A. Fisher, The wave of advance of advantageous genes, Ann. Eugen. 7 (1937), 335-369.

[29] C. K. Hays, A new travelling wave solution of Fisher's equation with density dependent diffusivity, J. Math. Biol. 29 (1991), 531-537.

[30] J. D. Murray, Mathematical Biology, Springer-Verlag, New York, 1993.

[31] Rolf D. Reitz, A study of numerical methods for reaction-diffusion equations, SIAM J. Sci. Stat. Comput. 2(1) (1981), 95-106.

[32] S. Ganesan, Solitary Waves in a Class of Nonlinear Diffusion Equation in Solitons and Nonlinear Systems, D. K. Sinha and P. Ghosh, eds., South Asian Publishers, New Delhi, 1986.