Using expanding method of (G'/G) to find the travelling wave solutions of nonlinear partial differential equations and solving *mkdv* equation by this method

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Abstract

Expanding method of (G'/G) can be implemented to find survey solutions of travelling wave of some nonlinear partial differential equations. The answers depend on hyperbolic functions, trigonometric functions and rational functions (see [1]).

This method, converts nonlinear partial differential equations into a plane differential equation. It is possible to use this method to solve integrable equations and non-integrable equations. In this paper, by describing the method we analysis the application of it to solve *mkdv* equation (see [2-3]).

Phenomenon in physics and other fields are often described by nonlinear partial differential equations. During 40 years ago, finding survey solutions of nonlinear partial differential equations by implementing different methods have been the target of many researchers and the powerful methods of inverse diffusion method, homogeneous equilibrium,.expanding method of (G'/G) are proposed that are based on assumptions that the solutions of travelling wave of nonlinear partial differential equations can be expressed in (G'/G) by polynomial and $G = G(\xi)$is correct in second order linear ordinary differential equations $(LODE)$. The degree of polynomial can be obtained by balance between the highest-order derivative of the dependent variable in linear part of the differential equation with highest-order of dependent variable in nonlinear part that is appeared in ODE.

Definitions and Basic preliminaries:

1.Balance number

balance number of m can be obtained by balance between the highest-order derivative of the dependent variable in linear part of the differential equation with highest-order of dependent variable in nonlinear part that is appeared in ODE.

2.Explaining of (G'/G) Expanding Method

We consider nonlinear differential with independent variable of x and t

$$P(u, u_t, u_x, u_tt, u_xt, u_xx, ...) = 0 \tag{1}$$

Which $u = u(x, t)$ is an unknown function, P is a polynomial in $u = u(x, t)$ and has been its various partial derivative that include higher order derivative and nonlinear parts.

3.Solving* mkdv *Method by (G'/G) Expanding Method

In this section, we consider *mkdv* as the following

$$u_t - u^2 u_x + \delta u_{xxx} = 0 \qquad \delta > 0 \tag{2}$$

We intend to find the solution of above traveling wave equation

$$u(x, t) = u(\xi) \qquad \xi = x - vt \tag{3}$$

The speed of V will be determined later.

In this paper, (G'/G) Expanding Method proposed by Wang, is used to solve *mkdv* method. It is clear that solving nonlinear partial differential equations needs suitable change of variable and after solving this kind of equation, we reach a solution. As we observed, by using (G'/G) Expanding Method, it is possible to solve these equations and have more solutions without considering specific change of variables. This method has various applications; as it is a direct and survey method to find travelling wave solutions of nonlinear partial differential equations and the outcome results can affect the future researches significantly.

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