

The Use of Homotopy Analysis Method to Solve the Time-Dependent Nonlinear Eikonal Partial Differential Equation

Mehdi Dehghan and Rezvan Salehi

Department of Applied Mathematics, Faculty of Mathematics and Computer Science,
Amirkabir University of Technology, No. 424, Hafez Ave., 15914, Tehran, Iran

Reprint requests to M. D.; E-mail: mdehghan@aut.ac.ir, mdehghan.aut@gmail.com
or R. S.; E-mail: rezvansalehi@aut.ac.ir

Z. Naturforsch. **66a**, 259 – 271 (2011); received April 8, 2010 / revised July 21, 2010

In this research work a time-dependent partial differential equation which has several important applications in science and engineering is investigated and a method is proposed to find its solution. In the current paper, the homotopy analysis method (HAM) is developed to solve the eikonal equation. The homotopy analysis method is one of the most effective methods to obtain series solution. HAM contains the auxiliary parameter \hbar , which provides us with a simple way to adjust and control the convergence region of a series solution. Furthermore, this method does not require any discretization, linearization or small perturbation and therefore reduces the numerical computation a lot. Some test problems are given to demonstrate the validity and applicability of the presented technique.

Key words: Homotopy Analysis Method; Eikonal Equation; Semi-Analytic Approaches;
Time-Dependent Partial Differential Equations; Applications;
Adomian Decomposition Method; Hamilton-Jacobi Equation.

AMS subject classifications: 74G10, 35C10, 70H20