Approximate analytical expressions of a boundary layer flow of viscous fluid using the modified Homotopy analysis method

[1]V. Ananthaswamy*, [2]T. Nithya, [3]V. K. Santhi

[1]Department of Mathematics, The Madura College, Madurai, Tamil Nadu, India

[2]Department of Mathematics, V. H. N. Senthikumara Nadar College, Virudhunagar, Tamil Nadu India

[3]Department of Mathematics, Sri Meenakshi Govt. Arts College for Women, Madurai, Tamil Nadu, India

**Corresponding author E-mail: ananthu9777@rediffmail.com*

Abstract:

The paper investigates the boundary layer flow of incompressible viscous fluid by solving the governing differential equations analytically using modified Homotopy analysis method. The effects of parameters Prandtl number and Eckert number on the flow are discussed and analyzed graphically. A comparison with the previous results shows a very good agreement.

Keywords:

Viscous fluid; Non-linear differential equations; Prandtl number; Eckert number; Modified Homotopy analysis method.

1. Introduction

The boundary layer flow of an incompressible viscous hydrodynamic fluid has attracted considerable attention during the last few decades due to its numerous applications in industrial manufacturing processes. The present study deals with the heat transfer flow of hydrodynamic viscous fluid over a flat fluid over a flat plate in a uniform stream of fluid with dissipation effect. The non-differential equations representing MHD flows are solved numerically and analytically by many Researchers [2]-[6].

Salah et.al., [1] performed numerical method to solve the system of non-linear differential equations. In this paper, modified Homotopy analysis is applied to solve the equations and the obtained results are compared with the numerical results. Graphs obtained on varying the governing parameters are also discussed in detail.

2. Mathematical formulation of the problem

The governing equations are given as:

$$\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=0 \tag{1}$$

$$u\frac{\partial u}{\partial x}+v\frac{\partial v}{\partial y}=\in\frac{\partial^2 u}{\partial y^2} \tag{2}$$