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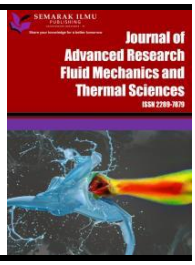

A Well-Founded Analytical Technique to Solve 2D Viscous Flow Between Slowly Expanding or Contracting Walls with Weak Permeability

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ABSTRACT

In this article, an analytical technique has been proposed for solving the model of two-dimensional viscous flow between slowly expanding or contracting walls with weak permeability. The idea of combining the Fourier transform and the homotopy perturbation method to yield a new technique was successful. The tables and graphs of the results of new analytical approximate solutions have illustrated the importance, usefulness, and necessity of using the new method. The results obtained showed the accuracy and efficiency of the new method compared to the previous methods, which were used to find the analytical approximate solutions for the current problem.

1. Introduction

The study of viscous flow theory, especially the flow of Newtonian and non-Newtonian fluids, has attracted the eye of scientists and engineers because of its important applications in various branches of science and technology. Many of these applications are based on non-linear ordinary or partial differential equations [8-10,17,18,22,24,25]. In the last years, several powerful methods have been developed to construct approximate solution of non-linear differential equations [1-7,19]. One of the foremost important problems of the fluid flow and which has interested many researchers that is the laminar flow of viscous fluid through a porous channel with contracting or expanding permeable walls. The seek for theoretical solutions about static flow of this kind began, as Berman [11] was able for the first time to find a series solution for the two-dimensional streamline flow of a viscous incompressible fluid during a parallel walled channel for the case of a very low cross-flow Reynolds number. This study paved the way for several researchers and authors who have studied this problem by watching the various variations of this problem, for instance, Ganji *et al.,* [13] used the homotopy perturbation method (HPM) to debate two-dimensional viscous fluid flow problem between slowly expanding or contracting walls. The comparison between the results of numerical method (NM) and the results of the homotopy perturbation method clarified that this method is very

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