A mathematical study on MHD plane Poiseuille flow in a porous channel with non-uniform plate temperature

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Abstract:

The objective of the paper is to examine the behaviour of plain Poiseuille MHD flow of an electrically conducting fluid when subjected to thermal conductivity and magnetic field. The coupled, non-linear differential equations governing the illustration are solved analytically using Homotopy analysis method (HAM). The effects of velocity and temperature on varying parameters are discussed graphically. Our analytical results are compared with the numerical results and a good agreement is noted.

Keywords:

Magneto hydro dynamic Poiseuille flow; Non-linear boundary value problem; Dimensionless velocity; Dimensionless temperature; Homotopy analysis method.

1. Introduction

MHD flow and heat transfer analysis of fluid through a channel in the presence of thermal and magnetic field plays a vital role in numerous branches of industries and engineering such as MHD generators, MHD pumps, accelerators, purification of crude oil, geothermal energy extraction and so on. The steady plane poiseuille fluid flow under the influence of magnetic field was investigated by [1]. [2] studied the plane Poiseuille flow problem with unequal wall temperature of an incompressible fluid having temperature dependent viscosity. The unsteady flow and heat transfer through a porous medium channel in the presence of a transverse magnetic field was discussed by [3] – [10]. [11] and [12] investigated the characteristics of poiseuille flow in their works. The flow in channels with porous plates was done by [13]-[17]. Whereas the Effects of uniform suction or injection on MHD flow in channels with porous plates were examined by [18] – [26]. Considering various feature of the problem, the present study deals with the effect of variable thermal conductivity on a steady MHD plane Poiseuille flow through non- uniform plate temperature and with constant injection or suction and Joule heating in