

عنوان مقاله:

A Numerical Study on Slip Flow Heat Transfer in Micro-Poiseuille Flow using Perturbation Method

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خلاصه مقاله:

In this study, slip-flow heat transfer in a laminar, steady state, two-dimensional incompressible flow between parallel plates micro-channel is investigated numerically. A new method based on perturbation expansion for modeling of slip micro-flows is presented. Navier-stokes equations are developed by using perturbation expansions of velocity, pressure and temperature fields. Different orders of equations depending on the magnitude of Knudsen number are obtained and each set of the equations are solved. The computations are performed for micro-channels with Constant Wall Heat Flux (CWHF) and Constant Wall Temperature (CWT) boundary conditions to obtain heat transfer characteristics of gaseous flow in slip regime. The effects of compressibility and viscous dissipation are neglected in this study. The numerical methodology is based on Semi-Implicit Method for Pressure-Linked Equations (SIMPLE) method. The effects of Knudsen number and thermal creep flow on Nusselt number are numerically investigated. This study confirms that the perturbation method with different orders of Knudsen number can predict the velocity and temperature fields with good accuracy. The obtained solutions are compared with both available numerical and analytical results and good agreement is obtained.

کلمات کلیدی:

Heat transfer, parallel, plates, Slip, Flow, perturbation expansion, Micro, channel, Nusselt number

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