The Dynamics of Unsteady Squeezing Flow between Parallel Plates (Two-Dimensional)

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Abstract : Unsteady squeezing flow of a viscous fluid between parallel plates is considered. The two plates are considered to be approaching each other symmetrically, causing the squeezing flow. Two-dimensional rectangular Cartesian coordinate is considered. The Navier-Stokes equation was reduced using similarity transformation to a single fourth order non-linear ordinary differential equation. The energy equation was transformed to a second order coupled differential equation. We obtained solution to the resulting ordinary differential equations via Homotopy Perturbation Method (HPM). HPM deforms a differential problem into a set of problem that are easier to solve and it produces analytic approximate expression in the form of an infinite power series by using only sixth and fifth terms for the velocity and temperature respectively. The results reveal that the proposed method is very effective and simple. Comparisons among present and existing solutions were provided and it is shown that the proposed method is in good agreement with Variation of Parameter Method (VPM). The effects of appropriate dimensionless parameters on the velocity profiles and temperature field are demonstrated with the aid of comprehensive graphs and tables.

Keywords : coupled differential equation, Homotopy Perturbation Method, plates, squeezing flow
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