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Cubic Interpolated Pseudo Particle (CIP) – Thermal BGK Lattice Boltzmann Numerical Scheme for Solving Incompressible Thermal Fluid Flow Problem

Nor Azwadi Che Sidik and Mohd Rosdzimin Abdul Rahman
Faculty of Mechanical Engineering,
Universiti Teknologi Malaysia,
81300 Skudai, Johor, Malaysia
E-mail: azwadi@fkm.utm.my

ABSTRACT

In this paper, cubic interpolated pseudo particle–lattice Boltzmann model is applied to simulate the natural convection of air in enclosure at various Rayleigh numbers. The basic idea is to discretise the advection term in lattice Boltzmann governing equation and solved using finite difference cubic-interpolated-pseudo-particle method. In our approach, two-dimensional nine-velocity model is coupled with two-dimensional four-velocity model to represent density and internal energy density distribution function respectively. Good agreement was obtained between the present approach and those by previous studies using Navier-Stokes solver and conventional LBM. The proposed approach is also found to be an efficient and stable numerical scheme for solving natural convection heat transfer problem.

Keywords: Natural convection, cubic-interpolated-pseudo-particle, lattice Boltzmann method, natural convection