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Hybrid Lattice-Boltzmann model for Thermally Coupled Fluid-Solid Problem LEITAO CHEN, LAURA SCHAEFER, University of Pittsburgh —

The most commonly used thermal boundary condition on solid wall in fluid problem is either type of Neumann or Dirichlet. However, the thermal boundary condition on solid wall in many practical problems is much more complicated and impossible to predict especially when the flow is unsteady or involves complex geometry such as porous media. So the best cure is to simulate fluid and solid together. Lattice-Boltzmann Method is becoming a promising alternative scheme for simulating thermal fluid flows while in the same time solving the conventional energy equation with Finite Volume method is still superior to other methods in modeling pure heat conduction in solid. In this work a 2D hybrid model is built, in which the traditional Lattice-Boltzmann BGK model on D2Q9 lattice for fluid part is coupled with the Finite Volume model on unstructured mesh for solid part. In addition, the numerical schemes on thermal fluid-solid interface for both straight and curved wall are developed. The Hybrid model is proved to be able to solve thermally coupled fluid-solid problem efficiently and accurately after several simulations are taken and their results are analyzed.

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