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Computational Method for Thermal Interactions between Compressible Fluids and Complicated-Shaped Structures with Multiphase Modeling

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In this paper, a new computational method based on multiphase model was presented to deal with the thermal interactions between compressible fluids and complicated-shaped structures as well as its mechanical interactions. The numerical procedures are divided into three processes, advection, diffusion and acoustic phases, and the phase averaged governing equations are discretized with a finite volume method (FVM). The present method was applied to the natural convection flows in a rectangular cavity and the calculation results were compared with the reference computational results for temperature and velocity distributions. As a result, it was shown that the natural convection flows could be reasonably simulated by our method. In addition, the natural convections arising in the porous media were calculated with the present method. Through the numerical experiments, its applicability to complicated-shaped structures was discussed.

Keywords: Compressible fluid, Complicated-shaped structure, Multiphase model, Natural convection.