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Computational Study of Flow and Heat Transfer Characteristics of an Incompressible Fluid in a Channel Using Lattice Boltzmann Method

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Abstract : The Lattice Boltzmann Method (LBM) is performed to computationally investigate the laminar flow and heat transfer of an incompressible fluid with constant material properties in a 2D channel with a built-in triangular prism. Both momentum and energy transport is modelled by the LBM. A uniform lattice structure with a single time relaxation rule is used. Interpolation methods are applied for obtaining a higher flexibility on the computational grid, where the information is transferred from the lattice structure to the computational grid by Lagrange interpolation. The flow is researched on for different Reynolds number, while Prandtl number is keeping constant as a 0.7. The results show how the presence of a triangular prism effects the flow and heat transfer patterns for the steady-state and unsteady-periodic flow regimes. As an evaluation of the accuracy of the developed LBM code, the results are compared with those obtained by a commercial CFD code. It is observed that the present LBM code produces results that have similar accuracy with the well-established CFD code, as an additionally, LBM needs much smaller CPU time for the prediction of the unsteady phonema.

Keywords : laminar forced convection, lbm, triangular prism
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