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Implementation of a generalised lattice Boltzmann method for external flow simulations JUAN ANTONIO REYES BARRAZA, RALF DEITERDING, Univ of Southampton — The lattice Boltzmann method is known for its computational efficiency and low numerical dissipation properties. Nonetheless, it is restricted to Cartesian grids, making this approach remarkably expensive for capturing boundary layers, and thereby impractical for external flow problems. A second-order finite difference numerical scheme is implemented to solve the discrete-velocity Boltzmann equation in generalised curvilinear coordinates to perform fluid flow simulations with non-uniform grids. Several test cases are used for verification, and the results have been compared with the available numerical and experimental literature with very favourable outcomes. Two-dimensional flows over a circular cylinder and NACA0012 aerofoil are specifically investigated to assess the accuracy and performance of the proposed approach. Additionally, the present method has been compared to our own standard Cartesian lattice Boltzmann solver with adaptive mesh refinement (AMROC-LBM) to demonstrate its advantages over the latter. The advantage of the present approach is capturing accurately large gradients in the wall vicinity with fewer mesh elements, which can lead to a dramatic reduction in computational effort over Cartesian lattice Boltzmann solvers.

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