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Simulation of flow over a sphere in a boundary layer using a
GPU accelerated IB-LBM

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University — Numerical simulations of flow over a sphere embedded in a laminar
boundary layer are conducted for characterizing the effects of wall proximity on
the drag and lift forces acting on the sphere. The wall proximity is defined as the
distance from the wall to the center of sphere. We utilize an immersed boundary-
lattice Boltzmann method (IB-LBM) with a multi-direct forcing technique (Suzuki
& Inamuro, Computers & Fluids 2011) and combine the present method with a
multi-block method (Yu et al., IJNMF 2002) for refining lattices near the sphere.
We implement the present IB-LBM into a Graphical Processing Unit (GPU) using
a PGI CUDA Fortran programming environment for accelerating the computations.
We perform benchmark tests based on simulations of flow over a sphere in a free-
stream for validations of the present IB-LBM and evaluations of the performance
of the GPU implementation. The results of the drag and lift forces on the sphere
according to the wall proximity will be shown in the final presentation.

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