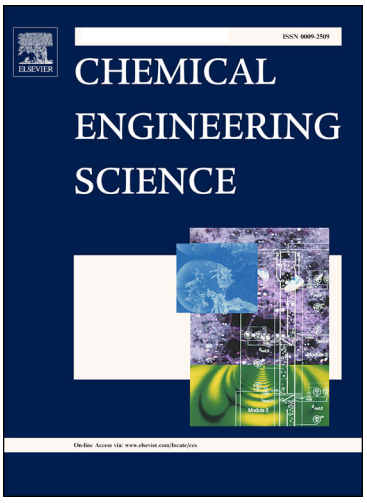

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Fluid-Structure Interaction Using Lattice Boltzmann Method: Moving Boundary Treatment and Discussion of Compressible Effect

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Abstract: We investigate fluid-structure interaction using lattice Boltzmann method (LBM), where we introduce a new simple treatment for moving boundary. Sub-grids are defined to separate structures from main-grid, thus structures can be created and calculated independently. Mapping and interpolation are used to connect main-grid and sub-grids. Our proposed simulation approach demonstrates high reliability and stability when compared to the direct bounce back method available in the literature. We validate the proposed approach by simulations of a single vibration cylinder in still water and in flowing water. The results show good agreement with theory and reference experiments. We find a delay of fluid force in the simulation of compact cylinder array, and conclude that Mach number (*Ma*) and boundary force term have a great influence on the accuracy of calculation results. *Ma* should be carefully chosen for a reliable result. Compressible effect in LBM and its influence on calculation of fluid-structure interaction, which has not been studied in detail, are also discussed in this paper. It is hard to avoid time delay effect under the framework of LBM according to the analysis, and this may lead to inaccurate results in fluid-structure interaction calculation using LBM under certain conditions, which deserve more