國立交通大學
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書報討論專題演講 Department Seminar

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Lattice Boltzmann and Immersed Boundary Method for Fluid-Solid Interactions

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Abstract

A flexible forcing immersed boundary–lattice Boltzmann model (IB–LBM) will be introduced in this talk. In the conventional IB–LBM scheme, explicit formulation of the force density term may not guarantee the exact satisfaction of the no–slip velocity or no–jump temperature boundary conditions. The unsatisfied boundary conditions may lead to the non–physical solutions such as, streamline and isotherm penetration into the solid boundary that further compromises the dynamic forces experienced by the solid from its surrounding fluid regime. In this research an implicit approach is followed where the force density term is obtained using a unique formulation with single Lagrangian velocity correction term (or a single Lagrangian temperature correction term, in case of thermal flow) operated in flexible number of forcing steps. With mathematical simplicity the proposed formulation removes the above identified defects and found to be computationally efficient. The proposed algorithm is further extended for three dimension flow studies and is validated with several bench mark test cases comprising of both 2D and 3D stationary and moving boundary flow scenarios. Finally, few experiments are conducted to support the numerical observations.

Profile

Dr. Sunil Manohar Dash is an Assistant Professor, in the Aerospace Engineering Department, at Indian Institute of Technology (IIT) Kharagpur, India. Prior to this position he has worked as, a Research Fellow in the International Design Center, at SUTD-MIT Alliance, Singapore and in the Mechanical Engineering Department at National University of Singapore, Singapore. He earned his Ph.D. Degree from National University of Singapore, Singapore in 2014, and B.Tech degree in Mechanical Engineering from National Institute of Technology (NIT) Rourkela, India in 2009. He has received a silver medal from the former president of India, Dr. A.P.J. Abdul Kalam and a gold medal from the Institution of Engineers India (IEI) for his excellent performance in his undergraduate studies. He has published more than 20 international journal and conference papers. His current research interests are in the field of flapping aerodynamics, active flow separation control using biomimetic design and experimental and computational fluid mechanics. His previous research experiences include numerical solver development using lattice Boltzmann scheme for fluid-solid interaction problems, natural convection in complex cavities, particle sedimentation problems.