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An efficient boundary condition enforced-immersed boundary method for thermal flows with heat flux condition WEIWEI REN, CHANG SHU, WENMING YANG, National University of Singapore, YU CHEN, Lloyd's Register Global Technology Center — An efficient boundary condition enforced-immersed boundary method (IBM) is proposed in this work for thermal flows involving complex geometries. By treating the heated immersed boundary as a series of heat sources/sinks, Peskin's original IBM has been extended to heat transfer problems with Neumann condition (heat flux) for the temperature field. The main feature of the present approach is to accurately satisfy the energy equation and its boundary conditions through a heat flux correction procedure, which is performed by introducing a heat source/sink term into the energy equation. The heat source/sink is evaluated from the offset boundary heat flux, which is generated from the difference between the normal temperature derivative in the given Neumann condition and the calculated derivative when the boundary effect is not considered. The present solver has proven to be of second order accuracy through a numerical analysis. Its capability and efficiency have also been validated by applying it to numerical examples like forced convection over a stationary heated circular cylinder and natural convection in a horizontal concentric and eccentric annulus between two circular cylinders, from which good agreements with the established data have been achieved.

Weiwei Ren
National University of Singapore

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