

# Block-Gauss-Seidel Immersed Boundary Method Accelerated by MUMPS

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## **Abstract**

A fully implicit immersed boundary method based on the direct forcing approach is presented to simulate incompressible flows around objects of irregular shape. The method is implemented on top of the block-Gauss-Seidel iteration accelerated by the direct MUMPS solver. Both incompressibility and kinematic constraints of no-slip are treated implicitly as Lagrange multipliers and are fully coupled with the velocity field. The results of the verification study applied to a number of canonical flows are presented. The future directions of applying the developed solver to the simulation of two-way coupled fluid-structure interaction configurations and multi-phase flows are discussed.