

Fast Multipole Methods for Incompressible Flow Simulation

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Our recent work has concentrated on the development of efficient software for matrix-vector multiplication using the Fast Multipole Method, and associated iterative solution schemes for solution of linear systems. We first discuss various scenarios in which Fast Multipole Methods may be used with profit in various incompressible flow simulations. These include solution of problems that admit integral equation formulations, such as potential flow, Stokes flow, and associated free-surface problems; particle methods such as vortex-element methods; and the solution of equations such as the pressure-Poisson and Helmholtz equations that arise in splitting schemes. We will then describe some recent results on improving the speed of fast multipole methods using faster translation operators and optimized data-structures. Finally we will present some preliminary results on developing black-box FMM software for use in such applications.