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An Efficient Immersed-Boundary Formulation with Explicit Time Stepping for Incompressible Flows NOAH OSMAN, University of Illinois at Urbana Champaign, ANDRES GOZA COLLABORATION — One of the most persistent difficulties in numerically simulating incompressible flow problems is the treatment of the stiff diffusive term. In order to maintain stability, this term is traditionally treated using an implicit time-stepping method, necessitating the solution to a large linear system at each time step. A variety of efficient techniques have been developed to solve these linear systems. However, their application in the presence of non-uniform grids and other non-canonical numerical configurations remains a challenge. We consider an alternative approach in which the diffusive term is treated explicitly, with no severe restrictions on the time step size. We present our method within an immersed-boundary formulation to enable efficient simulations of flows involving immersed bodies. To do this, we extend the Runge-Kutta Chebyshev method of Van der Houwen and Sommeijer (1980) to the differential-algebraic setting relevant to the immersed-boundary method. We demonstrate the efficacy of the method through results from canonical 2D flow problems.

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