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Comparison of Euler-Lagrange schemes in two-way coupled particle-laden channel flow[1] JEREMY HORWITZ, GIANLUCA IACCARINO, JOHN EATON, ALI MANI, Stanford University — Considerable recent work to advance the state-of-the-art in Euler-Lagrange modelling of particle-laden flows has focused on the development of methods to estimate the undisturbed fluid velocity. This quantity is needed to calculate the drag force, which couples the motion of particles to the fluid. Historically, the undisturbed fluid velocity was estimated as the interpolated fluid velocity at the particle location. However, this estimate can be highly inaccurate when the particle size is not small compared with the mesh size. Promising new approaches have been developed to accurately estimate the undisturbed fluid velocity at particle locations for particle sizes up to and exceeding the grid spacing. One limitation of these methodologies is that they apply strictly in unbounded settings, where the computed disturbance flow can freely decay. In wall-bounded configurations, the disturbance must decay more rapidly—to satisfy no-slip and no-penetration at solid boundaries. Though a number of existing schemes are suitable on anisotropic grid arrangements which are typical of wall-bounded flows, we demonstrate they nevertheless cannot accurately predict the undisturbed fluid velocity at all wall-normal separations. We present an alternative paradigm which can improve undisturbed fluid velocity predictions in wall-bounded environments and apply this methodology to turbulent particle-laden channel flow.

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