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An Accurate Time Advancement Algorithm for Particle Tracking PAVEL POPOV, Aerospace Engineering, Cornell University, STEPHEN POPE, Mechanical and Aerospace Engineering, Cornell University — We describe a particleposition time-advancement algorithm that is designed for use with several subgrid velocity reconstruction schemes used in LES/FDF methods, and potentially in other applications. These reconstruction schemes yield a subgrid velocity field with desirable divergence properties, but also with discontinuities across grid faces. Therefore, a conventional time advancement algorithm, such as second-order Runge-Kutta (RK2), does not perform as well as it does with a smooth velocity field. The algorithm that we will describe, called Multi-step RK2 (MRK2), builds upon RK2 by breaking up the time step into two or more substeps whenever a particle crosses one or more velocity discontinuities. When used in conjunction with the Parabolic Edge Reconstruction Method, MRK2 performs considerably better than RK2: both the final position of an advected particle, and the final area of an infinitesimal area element are second-order accurate in time (as opposed to first-order accurate for RK2). Furthermore, MRK2 has the theoretical advantage that it preserves the continuity of the mapping between initial and final particle positions.

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