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New techniques for meshless flow simulation generalizing moving least squares[1] NATHANIEL TRASK, MARTIN MAXEY, Brown University — While the Lagrangian nature of SPH offers unique flexibility in application problems, practitioners are forced to choose between compatibility in div/grad operators or low accuracy limiting the scope of the method. In this work, two new discretization frameworks are introduced that extend concepts from finite difference methods to a meshless context: one generalizing the high-order convergence of compact finite differences and another generalizing the enhanced stability of staggered marker-and-cell schemes. The discretizations are based on a novel polynomial reconstruction process that allows arbitrary order polynomial accuracy for both the differential operators and general boundary conditions while maintaining stability and computational efficiency. We demonstrate how the method fits neatly into the ISPH framework and offers a new degree of fidelity and accuracy in Lagrangian particle methods.

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