Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Methods to Prescribe Particle Motion to Minimize Quadrature Error in Meshfree Methods JEREMY TEMPLETON, LINDSAY ERICKSON, KARLA MORRIS, DAVID POLIAKOFF, Sandia National Laboratories — Meshfree methods are an attractive approach for simulating material systems undergoing large-scale deformation, such as spray break up, free surface flows, and droplets. Particles, which can be easily moved, are used as nodes and/or quadrature points rather than a relying on a fixed mesh. Most methods move particles according to the local fluid velocity that allows for the convection terms in the Navier-Stokes equations to be easily accounted for. However, this is a trade-off against numerical accuracy as the flow can often move particles to configurations with high quadrature error, and artificial compressibility is often required to prevent particles from forming undesirable regions of high and low concentrations. In this work, we consider the other side of the trade-off: moving particles based on reducing numerical error. Methods derived from molecular dynamics show that particles can be moved to minimize a surrogate for the solution error, resulting in substantially more accurate simulations at a fixed cost. Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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Date submitted: 31 Jul 2015 Electronic form version 1.4