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Multi-resolution flow simulations by smoothed particle hydrodynamics via domain decomposition[1] XIN BIAN, ZHEN LI, YU-HANG TANG, GEORGE KARNIADAKIS, Brown University — We present a methodology to concurrently couple particle-based methods via a domain decomposition (DD) technique for simulating viscous flows. In particular, we select two resolutions of the smoothed particle hydrodynamics (SPH) method as demonstration. Within the DD framework, a simulation domain is decomposed into two (or more) overlapping subdomains, each of which has an individual *particle scale* determined by the local flow physics. Consistency of the two sub-domains is achieved in the overlap region by matching the two independent simulations based on Lagrangian interpolation of *state variables* and *fluxes*. The domain decomposition based SPH method (DD-SPH) employs different spatial and temporal resolutions, and hence, each sub-domain has its own smoothing length and time step. As a consequence, particle refinement and derefinement are performed *asynchronously* according to individual time advancement of each sub-domain. The proposed strategy avoids SPH force interactions between different resolutions on purpose, so that coupling, in principle, can go beyond SPH - SPH, and may allow SPH to be coupled with other mesoscopic or microscopic particle methods. The DD-SPH method is validated first for a transient Couette flow, where simulation results base

[1]US DOE Collaboratory on Mathematics for Mesoscopic Modeling of Materials (CM4)

George Karniadakis
Brown University

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