Abstract Submitted
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Implementing Multiscale Fluid Simulations using Multiscale Universal Interface[1] YU-HANG TANG, Division of Applied Mathematics, Brown University, USA, SHUHEI KUDO, The University of Electro-Communications, Tokyo, Japan, XIN BIAN, ZHEN LI, GEORGE KARNIADAKIS, Division of Applied Mathematics, Brown University, USA, CRUNCH TEAM — The power of multiscale fluid simulations lies in its ability to recover a hierarchical levels of details by choreographing multiple solvers, thus extending the length and time scale accessible given a fixed amount of computing power. However, practical difficulties frequently arise when stitching together solvers which were not designed to be coupled, and would often result in tedious and unsustainable coding effort. The Multiscale Universal Interface (MUI) aims to solve this problem by exposing a small set of generalized programming interfaces that can be dropped into existing solvers with minimal intrusion. Three deployment cases will be given for demonstrating real-world applications of MUI. In the first case we used MUI to implement simulations of polymer-grafted surface in flow using Smoothed Particle Hydrodynamics/Dissipative Particle Dynamics (SPH/DPD) and state variable coupling. In the second case we constructed coupled DPD/Finite Element Method (FEM) simulation of conjugate heat transfer in heterogeneous coolant. In the third case we built hybrid DPD/molecular dynamics (MD) simulations by blending the forces on atoms at interface regions.

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