DIRECT SIMULATION OF EXPLOSIVE DISPERSAL OF DENSE PARTICLES

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ABSTRACT

In this paper, we present a Cartesian grid based numerical framework for direct simulation of particulate flow with shocked flow conditions, arbitrarily irregular particle shapes, and realistic multi-body collisions. This framework is mainly established on integrating the following numerical techniques: 1) Operator splitting for partitioned fluid-solid interaction in the time domain. 2) Third-order SSP Runge-Kutta method and fifth-order WENO scheme for temporal and spatial discretization of governing equations. 3) Front tracking method for tracking phase interfaces. 4) A novel field function for low-memory-cost multimaterial mesh generation and fast collision detection. 5) A novel sharp interface immersed boundary method for treating arbitrarily irregular and changing boundaries. 6) Realistic multi-body collision modeling. Numerical experiments concerning shock-cylinder diffraction, transient rotational flow, and explosive dispersal of dense particle systems are conducted to demonstrate the applicability and feasibility of the presented framework.