Shock-Driven Fluid-Structure Interaction for Civil Design

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Abstract

The multiphysics fluid-structure interaction simulation of shock-loaded structures requires the dynamic coupling of a shock-capturing flow solver to a solid mechanics solver for large deformations. The Virtual Test Facility combines a Cartesian embedded boundary approach with dynamic mesh adaptation in a generic software framework of flow solvers using hydrodynamic finite volume upwind schemes that are coupled to various explicit finite element solid dynamics solvers (Deiterding et al., 2006). This paper gives a brief overview of the computational approach and presents first simulations that utilize the general purpose solid dynamics code DYNA3D for complex 3D structures of interest in civil engineering. Results from simulations of a reinforced column, highway bridge, multistory building, and nuclear reactor building are presented.

Keywords: Fluid-structure interaction, Blast wave, Civil engineering