An alternated finite difference material point method for numerical simulation

of high explosive explosion problems

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Abstract:

Based on the material point method (MPM), an alternated finite difference material point method (AFDMPM) is proposed for modeling the 3D high explosive (HE) explosion and its interaction with structures nearby. The initiatory detonation and eventual fluid structure interaction (FSI) processes are simulated by the standard MPM, while the finite difference method (FDM) is employed to simulate the dispersion process of detonation products to surrounding medium, in which particles are degenerated to marker points to track the moving interface between detonation products and air. The conversion between MPM and FDM is implemented by the projection between the particles' variables in MPM and the cell centers' variables in FDM. Several numerical tests are in good agreement with theoretical solutions and empirical formula, which shows that the proposed method can give good prediction for the whole process of HE explosion problems.

Keywords: High explosive explosion, Material point method, multi-material finite difference method, marker points, fluid structure interaction