33−35 Numerical simulation on the flight of metal plate accelerated by over-driven detonation

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The explosive acceleration is commonly used to achieve a high-velocity motion for a metal plate.Under general conditions, the detonation in the explosive progresses in a way satisfying the Chapman-Jouguet (C-J) assumptions. Therefore, the expansion of the detonation products commences from the state at which the detonation properties are generally designated as C-J values. When an explosive is detonated under the extreme condition such as the high pressure input, the over-driven detonation may be incurred in the explosive. The detonation products from the over-driven detonation may provide a larger pressure than does the C-J detonation depending on the input strength of initiating pressure. The occurrence of the over-driven detonation is undoubtedly able to be expected for the acquirement of high velocity. This paper presents a numerical study on the flight of the metal plate normally accelerated by the over-driven detonation products resulting from the impact of a flyer upon the explosive. The calculation is performed by a code which solves the conservative equations of mass, momentum and energy using Lagrangian finite difference scheme. The materials of metal plate and flver are treated as the elastic perfectly plastic body. The detonation of solid explosive into the gaseous products is modeled by "C-J volume burn" technique. The simulation demonstrates that the over-driven detonation can greatly accelerate the metal plate to the higher velocity than the C-J detonation does. At the same time, the results also reveal that the accelerated metal plate undergoes a great deformation along the radial distribution during the acceleration. The control on the deformation should be further studied in the future for the various applications.

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