The Material Point Method for Simulations of Soil Impact Problems

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ABSTRACT

The material point method [1] (MPM) is an extension of particle-in-cell (PIC) method to solid mechanics. Being a fully Lagrangian particle method, it discretizes a material domain using a collection of material points. The momentum equations are solved on a predefined regular background grid, so that the grid distortion and entanglement are completely avoided.

The penetration process of a hemispherical shell into soil is simulated by MPM. The problem is also solved by using the LS-DYNA code based finite element method (FEM). The material of the hemispherical shell is an aluminium alloy. The hemispherical shell impacts into the soil with velocity of 45 m/s. Figure 1(a) shows the simulated result by MPM, Figure 1(b) shows the simulated result by LS-DYNA code, and Figure 1(c) shows the experimental result [2].

When the hemispherical shell impacts into the soil with velocity of 200 m/s, this problem is also simulated by FEM and MPM. FEM cannot simulate the soil impact problems with high velocity, but MPM can efficiently simulate the soil impact problems with high velocity.

![Figure 1. Results of the hemispherical shell impacting into the soil (45 m/s)](image)

REFERENCES
