NUMERICAL SIMULATION OF AN EXPERIMENT ON PLATE THROWING BY DETONATION PRODUCTS

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One of the well-known methods for determining the propellant ability of explosives is experiments on throwing plates with detonation products. This technique allows us to obtain an estimate of the energy parameters of explosives. It should be noted that the problem of throwing bodies by explosive detonation products is a complex three-dimensional non-stationary problem of continuum mechanics, in which it is necessary to take into account not only the compressibility, but also the strength of the bodies being thrown. A complete solution to such a problem is possible only by numerical methods and requires a large amount of time at the current level of development of numerical methods and computing technology, which is not acceptable for engineering practice. A more accessible solution is the one-dimensional and two-dimensional problem of throwing plates and shells by detonation products during an explosive charge explosion [1].

The numerical solution of problems on the interaction of a moving gas with a solid deformable body is complicated by the fact that it is necessary to solve the problem of conjugation of Eulerian (gas motion) and Lagrangian (solid motion) regions. This paper presents the results of numerical modeling of plate throwing by detonation products in a software package that implements the conjugation of two Lagrangian (body wall and plate) and Eulerian (detonation products) regions, as well as the conjugation of boundary conditions at contact boundaries at each countable time step [2]. The motion of a solid body is described by a model of two-dimensional elastoplastic flows in Lagrangian variables, and the motion of a gas by a model of two-dimensional gasdynamic flows in Eulerian variables. Numerical modeling is carried out using a semi-analytical method [3], the feature of which is the replacement of only derivatives with finite differences in space. This approach allows us to switch to a system of ordinary differential equations having an approximate analytical solution over a short time interval.

The results obtained are in good agreement with experimental data [4], which allows us to conclude that the software package is applicable to solving problems of determining the propellant ability of explosives.

References

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