Modeling of cylindrical shell collapse in finite deformations

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Experiments on collapse of cylindrical and spherical metal shells are used for researching the deformation behavior of metals in the conditions of energy cumulation in the converging shock wave. A significant experimental material has been accumulated currently [1]. This problem is of interest for the studying elastoplastic flows and destruction of the crystal structure of a metal at high strain rates and values. For example, the problem of collapsing metal cylinders implies that the material is underwent a relative deformation much greater than unity. To describe this process, the previously developed model of dislocation plasticity [2, 3] requires generalization to the case of large deformations.

We use the approximation of the results of a molecular dynamics (MD) simulations for description of the behavior of aluminum sample. The dependencies between the stresses in a sample and his deformation are obtained from MD simulation. Approximation of these dependencies allows us to define the elastic component of deformation with using the deformation gradients and Green's deformation tensor. This approach allows us to solve wider specter of problems about propagation of shock waves in amaterials with ignoring the requirements of smallness of displacement gradients.

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[3] Mayer A E, Khishchenko K V, Levashov P R and Mayer P N 2013 *J. Appl. Phys* **113** 193508