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Mathematical and Numerical Modeling of Elastic-Plastic Waves in Granular Materials

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To describe a deformation of materials with different resistance to tension and compression the rheological method is supplemented by a new element-rigid contact. It is used to construct a model of granular medium possessing elastic and plastic properties. Loosened state is determined by Mises-Schleiher strength condition, plastic state – by Mises yield condition. The propagation of plane longitudinal compression shock waves is analyzed analytically in one-dimensional case. It is shown that velocities of such waves decrease with loosening of material ahead of front, and that one- or two-wave configuration occurs depending on the intensity of compression and the degree of initial loosening. Effective numerical algorithm is developed on the basis of the space-variable decomposition for multidimensional analysis. By means of computational experiments the next effect is found: plane fronts of two shock waves, bending due to inhomogeneous loosening, can be reflected from each other with formation of transverse cumulative splash.

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