Computations in Dynamics of Incompressible Nonlinear Elastic Medium by Using Near-front Ray Expansions of Solutions

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The present work deals with propagation curvilinear (cylindrical) shock waves in nonlinear elastic medium. As an example we consider one-dimensional problems concerning the anti-plane and twisted motion of an incompressible nonlinear elastic medium. Analytical solutions to these problems were obtained by the ray method. The latter lies in the fact that functions to be found behind the wavefront are represented in terms of series like Taylor's series [1,2]. The coefficients are the discontinuities in the strains and their derivatives on moving discontinuity surface. These coefficients are related to one another by the compatibility conditions for the discontinuities. The ray method modification for shock waves was proposed in [3]. The approximate solutions obtained in this way will be the closer to the exact solutions the smaller post-impact times considered. The subsequent shock loading process we computed numerically by use of a finite-difference method. The ray expansion of solution was applied to determine the wavefront position at every time step and to find a solution near the wavefront. The way of matching the near-front analytical solution and the numerical solution by the least-square technique is presented. Numerical solutions for the problems under study are illustrated graphically. In [4] this approach was implemented for plane shock waves.

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