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A Theoretical Approach for Shock Strengthening in High-Energy-Density Laser Compression Experiments[1] MICHAEL WADAS, GRIFFIN CEARLEY, ERIC JOHNSEN, University of Michigan, MARIUS MILLOT, Lawrence Livermore National Lab — The design of shock compression experiments in high-energy-density systems typically requires shocks to pass through different materials to achieve the desired state of compression. In this study, a theoretical approach for strengthening such shock waves is examined. A method based on characteristic analysis is used to semi-analytically solve the problem of a shock passing through a region of non-uniform density to increase the strength of the shock initially transmitted into the experimental target. It is found that incorporating multiple intermediate density steps between two materials can increase the strength of the transmitted wave. Furthermore, it is shown that an exponential discretization of intermediate density steps is the most efficient distribution for shock strengthening. The technique is applied to the design of laser-driven dynamic compression experiments, and the results of the analysis are verified via comparison to simulations performed with the HYADES hydrodynamics code.

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