Abstract Submitted
for the SHOCK15 Meeting of
The American Physical Society

Non-iterative determination of the stress-density relation from ramp wave data[1] DAMIAN SWIFT, DAYNE FRATANDUONO, RICHARD KRAUS, Lawrence Livermore National Laboratory — In the canonical ramp compression experiment, a smoothly-increasing load is applied the surface of the sample, and the particle velocity history is measured at interfaces two or more different distances into the sample. The velocity histories are used to deduce a stress-density relation, usually via the iterative Lagrangian analysis technique of Rothman and Maw. In this technique, a stress-density relation is assumed, and is adjusted until characteristics propagated back from the step interfaces give a self-consistent load within the sample. This process is subject to the usual difficulties of nonlinear optimization, such as the existence of local minima (sensitivity to the initial guess), possible failure to converge, and relatively large computational effort. We show that, by considering the interaction of successive characteristics reaching the interfaces, the stress-density relation can be deduced directly by recursion rather than iteration. This calculation is orders of magnitude faster than iterative analysis, and does not require the solution to be guessed. Direct recursion may be less suitable for very noisy data, but it was robust when applied to trial data. The stress-density relation deduced was identical to the result from iterative Lagrangian analysis.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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Date submitted: 30 Jan 2015 Electronic form version 1.4