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A Scale Invariant Equation of State for Gruneisen Materials EMMA SCHMIDT, JENNIFER LILIEHOLM, SCOTT RAMSEY, ZACHARY BOYD, Los Alamos National Laboratory — Scale-invariant equations of state are required for the existence of the Noh, Sedov, and Guderley compressible flow similarity solutions in the general case. All of these problems are self-similar and their solutions are independent of space, time, and the hydrodynamic state of the system. This work establishes a new equation of state with hydrodynamic scaling properties that may be used to approximate Gruneisen materials. The Gruneisen equation of state is relevant for materials whose atoms are limited to small vibrations; however the Gruneisen EOS is shown to lack the form necessary to yield a scaling solution in the general case. A Virial EOS with coefficients reminiscent of Gruneisen materials is proposed and derived, and shown to possess the desired hydrodynamic scaling properties. The divergence of the approximation from the true Gruneisen EOS under strong shock conditions is discussed.

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