Abstract Submitted
for the SHOCK07 Meeting of
The American Physical Society

Estimate of shock Hugoniot adiabat of liquids from hydrodynamics ERIC BOUTON, CEA, Le Ripault, BP 16, 37260 Monts, France, PIERRE VIDAL, Laboratoire de Combustion et detonique, UPR 9028 CNRS, 86960 Futuroscope, France — Predicting the Hugoniot shock states in liquids is of fundamental interest for numerical simulations and experimental investigations. Shock states are generally obtained from shock velocity (D) and material speed (u) measurements. In this paper, we propose two hydrodynamical methods for estimating the (D-u) Hugoniot curve of liquids from easily measured properties of the initial state. The first method is based upon the well-known experimental fact that for many liquids the shock adiabat is unique in a normalized plot. We then propose a quadratic form for this universal Hugoniot with only two parameters derived from physical considerations without fitting the experimental data. This relation is valid for liquids that do not undergo shock-induced phase under shock-pressure. The second method is based upon the differentiation of the Rankine-Hugoniot relations with the initial temperature considered as a variable and under the constraint of a unique nondimensional shock adiabat. We then obtain an ordinary differential equation (ODE) for the shock velocity D in the variable u. Upon integration, both methods predict the shock Hugoniot of liquid Nitromethane with a 10 % accuracy for any initial temperature varying in the range from 250 K to 360K.

Eric Bouton
CEA, Le Ripault, BP 16, 37260 Monts, France

Date submitted: 20 Feb 2007 Electronic form version 1.4