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Modeling the Propagation of Shock Waves in Metals W. MICHAEL HOWARD, JOHN D. MOLITORIS, Lawrence Livermore National Laboratory —

We present modeling results for the propagation of strong shock waves in metals. In particular, we use an arbitrary Lagrange Eulerian (ALE3D) code to model the propagation of strong pressure waves (P ∼300 to 400 kbars) generated with high explosives in contact with aluminum cylinders. The aluminum cylinders are assumed to be both flat-topped and have large-amplitude curved surfaces. We use 3D Lagrange mechanics. For the aluminum we use a rate-independent Steinberg-Guinan model, where the yield strength and bulk modulus depends on pressure, density and temperature. The calculation of the melt temperature is based on the Lindermann law. At melt the yield strength and bulk modulus is set to zero. The pressure is represented as a seven-term polynomial as a function of density. For the HMX-based high explosive, we use a JWL, with a program burn model that gives the correct detonation velocity and C-J pressure (P ∼ 390 kbars). For the case of the large-amplitude curved surface, we discuss the evolving shock structure in terms of the early shock propagation experiments by Sakharov. We also discuss the dependence of our results upon our material model for aluminum.

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