Abstract Submitted
for the SHOCK07 Meeting of
The American Physical Society

Reactive Flow Calculation near a Free Boundary. YEHUDA PARTOM, RAFAEL — In reactive flow calculations of detonation in a rod, an unreacted layer is formed at the boundary, affecting the diameter effect outcome. We investigate the origin of this boundary layer, and propose a simple and practical way to eliminate it. We show that it is an artifact of the finite rise time of the shock, caused by artificial viscosity. When the shock reaches a boundary cell, it releases right away, so that pressure and temperature there only reach a fraction of their shock levels, and the reaction rate is slow. We propose to remedy this artifact by delaying the boundary motion for a short while (40 nsec for a 10 cells per mm mesh) after arrival of the shock. In this way the boundary cells reach the appropriate pressure and temperature and react at the appropriate rate. In the paper we show how this remedy works. We compute detonation in a rod with different values of the boundary motion delay, compare the breakout curve from the far end with data from the literature, and obtain good agreement. This finite rise time effect near a low impedance boundary plays a role also in calculations of corner turning situations. But there the detonation borders with a dead zone, and the boundary contour is not known in advance.

Yehuda Partom
RAFAEL

Date submitted: 30 Jan 2007 Electronic form version 1.4