Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Optimal Parameterization of DSD Programmed Burn Models in ALE3D with DAKOTA KEVIN MIERS, ADAM ENEA, BRIAN TRAVERS, US Army CCDC Armaments Center — Diverging curved detonation waves propagate slower than planar CJ detonations due to geometric source terms in the reaction zone equations, while still being decoupled from the products expansion region. When the reaction zone thickness is small compared to the radius of curvature of the front, the length and time scales for the reaction zone dynamics are much smaller than those for the flow in the reaction products, and the propagation can be considered quasi-steady. In this case, the reaction zone dynamics can be described by a simple dependence of the front propagation velocity Dn on its local curvature κ. This theory is often called Detonation Shock Dynamics (DSD), and enables curved detonation fronts to be accurately modeled in 2D/3D without directly resolving the reaction zone, achieving a substantial computational cost savings. The US Army CCDC-AC is developing the capability to obtain simple Dn–κ relations for military explosives from rate stick experiments. In this work, constrained nonlinear optimization routines in DAKOTA are utilized in conjunction with the hydrocode ALE3D to optimally parameterize a DSD model for an already well-characterized explosive using available experimental data. The computational framework utilized is described, and the results of the methodology are compared with existing fits.

Kevin Miers
US Army CCDC Armaments Center

Date submitted: 02 Mar 2019 Electronic form version 1.4