Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

Analysis of a Multi-Fidelity Surrogate for Handling Real Gas Equations of State[1] FREDERICK OUELLET, CHANYOUNG PARK, University of Florida, BERTRAND ROLLIN, Embry-Riddle Aeronautical University, S. BALACHANDAR, University of Florida — The explosive dispersal of particles is a complex multiphase and multi-species fluid flow problem. In these flows, the detonation products of the explosive must be treated as real gas while the ideal gas equation of state is used for the surrounding air. As the products expand outward from the detonation point, they mix with ambient air and create a mixing region where both state equations must be satisfied. One of the most accurate, yet computationally expensive, methods to handle this problem is an algorithm that iterates between both equations of state until pressure and thermal equilibrium are achieved inside of each computational cell. This work aims to use a multi-fidelity surrogate model to replace this process. A Kriging model is used to produce a curve fit which interpolates selected data from the iterative algorithm using Bayesian statistics. We study the model performance with respect to the iterative method in simulations using a finite volume code. The model's (i) computational speed, (ii) memory requirements and (iii) computational accuracy are analyzed to show the benefits of this novel approach. Also, optimizing the combination of model accuracy and computational speed through the choice of sampling points is explained.

[1]This work was supported by the U.S. Department of Energy, National Nuclear Security Administration, Advanced Simulation and Computing Program as a Cooperative Agreement under the Predictive Science Academic Alliance Program under Contract No. DE-NA0002378

Frederick Ouellet
University of Florida

Date submitted: 23 Feb 2017 Electronic form version 1.4