Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Effects of Surface Tension on the Richtmyer-Meshkov-Instability-Induced Perturbation Growth in Fully Compressible and Inviscid Fluids
KAITAO TANG, Center for Combustion Energy and School of Aerospace Engineering, Tsinghua University, Beijing, 100084, China, WOUTER MOSTERT, Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, NJ 08544, USA, DANIEL FUSTER, Sorbonne Universites, UPMC Univ Paris 06, CNRS, UMR 7190, Institut Jean Le Rond d'Alembert, F-75005 Paris, France, LUC DEIKE, Department of Mechanical and Aerospace Engineering and Princeton Environmental Institute, Princeton University, Princeton, NJ 08544, USA — We present novel numerical simulations investigating the Richtmyer-Meshkov instability (RMI) with surface tension. With a fully nonlinear, compressible numerical formulation which directly models surface tension on a volume-of-fluid interface, we validate and bridge existing theoretical models of surface tension's effects on the RMI in linear, transitional and nonlinear post-shock growth regimes. We propose a dimensional scheme, from which we first develop scaled models for the perturbation growth in the small-amplitude (linear) oscillatory regime, where good collapses of simulation data are found under the scalings. Next, we heuristically identify a criterion for transition into a nonlinear oscillation regime. Finally, we show good agreement with nonlinear theory for asymptotic interface growth in the limit of small surface tension. These results highlight the utility of our model for compressible problems featuring surface tension, and pave the way for a broader investigation into mixed compressible/incompressible problems.

Kaitao Tang
Tsinghua University

Date submitted: 30 Jul 2020 Electronic form version 1.4