Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Richtmyer-Meshkov instability in shock-flame interactions LUCA MASSA, University of Texas at Arlington, PALLAV JHA COLLABORATION — Shock–flame interactions occur in supersonic mixing and detonation formation. Therefore, their analysis is important to explosion safety, internal combustion engine performance, and supersonic combustor design. The fundamental process at the basis of the interaction is the Richtmyer-Meshkov instability supported by the density difference between burnt and fresh mixtures. In the present study we analyze the effect of reactivity on the Richtmyer- Meshkov instability with particular emphasis on combustion lengths that typify the scaling between perturbation growth and induction. The results of the present linear analysis study show that reactivity changes the perturbation growth rate by developing a non-zero pressure gradient at the flame surface. The baroclinic torque based on the density gradient across the flame acts to slow down the instability growth for high wave numbers. A non-hydrodynamic flame representation leads to the definition of an additional scaling Peclet number, the effects of which are investigated. It is found that an increased flame-contact separation destabilizes the contact discontinuity by augmenting the tangential shear.

Luca Massa
University of Texas at Arlington

Date submitted: 05 Aug 2011 Electronic form version 1.4