Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Effects of Stochasticity on Deflagration-to-Detonation Transition in Obstructed Channels V.N. GAMEZO, E.S. ORAN, LCP & FD, Naval Research Laboratory, T. OGAWA, Seikei University, Tokyo, Japan — Deflagration-to-Detonation Transition (DDT) in obstructed channels involves multiple stochastic phenomena, including flow instabilities, turbulence, many interactions between shocks, flames, and vortices, and the resulting hot-spot formation. Since the detonation usually arises from one of many hot spots that stochastically appear in the system, there is some uncertainty in time and location for the detonation initiation. Small fluctuations of density, temperature, and composition play an important role in the development of stochasticity in experimental systems, which are also affected by uncertainties in initial conditions. The real cause of stochasticity, however, is embedded in the complexity of underlying physical phenomena, and can cause a stochastic behavior of numerical solutions that model these phenomena. Here we use a deterministic numerical model based on reactive Navier-Stokes equations that are solved using a deterministic method. Stochastic properties of the model system are evaluated using multiple numerical experiments for the same configuration. To trigger the stochastic response, we vary the initial background temperature within an interval of 0.01 K, which is too small to have systematic effects on the solution. Resulting run-up distances to DDT show a stochastic dispersion similar to that observed in physical experiments.

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Date submitted: 04 Aug 2008 Electronic form version 1.4