Abstract for an Invited Paper
for the DFD08 Meeting of
The American Physical Society

Numerical Modeling of Multi-dimensional Acoustic Timescale Detonation Initiation

OLEG VASILYEV, University of Colorado at Boulder

In this talk we discuss the issues related to modeling and simulation of acoustic timescale detonation initiation. Momentary, partial inertial confinement resulting from localized heat addition on time scales comparable with the local acoustic time causes a high pressure and temperature reaction center. Subsequent gasdynamic processes including wave reflections lead to the spontaneous appearance of numerous additional reaction centers that promote the development of an overdriven detonation. One of the main difficulties encountered when numerically modeling detonation initiation through localized thermal energy deposition is coping with the numerous spatial and temporal scales involved. The reaction and energy deposition zones are quite small in comparison to the entire detonation tube and the energy is deposited on sub-acoustic timescales. The multiplicity of scales makes it challenging to accurately model the initiation process in a truly multi-dimensional sense. In order to deal with these challenges, we use the Adaptive Wavelet Collocation Method with shock capturing capabilities, which ensures adequate resolution of the transient dynamics leading to detonation initiation. The details of the method are discussed and the results of two-dimensional simulations in a channel initiated by thermal power deposition into a small circular region are presented. In collaboration with David R. Kassoy and Jonathan D. Regele, University of Colorado at Boulder.