

‘Explosion in the Explosion’ and the Onset of Detonation

S. Dorofeev

FM Global, 1151 Boston-Providence Turnpike, Norwood, MA 02062, USA

sergey.dorofeev@fmglobal.com

The processes of deflagration to detonation transition (DDT) in gaseous mixtures have attracted intense interest for a considerable time due to both their fundamental and practical importance. Since the invention of the rotating mirror camera in 1920th, studies of DDT have revealed a puzzling complexity of the wave interaction processes leading to the onset of detonation. Further improvements in experimental techniques and analysis efforts culminated in 1960^s with the classical studies of A. K. Oppenheim, who introduced the concept of ‘explosion in the explosion’ as a final event in DDT that actually results in the onset of detonation. Since that time processes of the onset of detonations were studied by many researchers in smooth tubes, in channels with repeated obstacles, and in other experimental situations, including photochemical systems, hot turbulent jets, and shock-flame interactions. Mechanisms involved in the processes of the onset of detonations were analyzed analytically and numerically. This presentation intends to review the progress in our understanding of the onset of detonation since the ‘explosion in the explosion’ event has been introduced by A. K. Oppenheim. What is the nature of the final stages of the transition process? What is modern understanding of ‘explosion in the explosion’ event? Why do certain critical conditions exist in the onset of detonation? These and other important questions that are related to fundamental aspects of the transition to detonation are discussed in the presentation.