Springer
Acta Mechanica Sinica
The Chinese Society of Theoretical and Applied Mechanics (CSTAM)

Acta Mechanica Sinica » 2011, Vol. 27 » Issue (6) :922-928 DOI: 10.1007/s10409-011-0508-y

Periodic oscillation and fine structure of wedge-induced oblique detonation waves

Ming-Yue Gui[1], Bao-Chun Fan[1], Gang Dong[1]

1. State Key Laboratory of Transient Physics, Nanjing University of Science and Technology, 210094 Nanjing, China;
2. State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology, 100081 Beijing, China

Abstract An oblique detonation wave for a Mach 7 inlet flow over a long enough wedge of 30 turning angle is simulated numerically using Euler equation and one-step rection model. The fifth-order WENO scheme is adopted to capture the shock wave. The numerical results show that with the compression of the wedge wall the detonation wave front structure is divided into three sections: the ZND model-like strcuture, single-sided triple point structure and dual-headed triple point strucuture. The first structure is the smooth straight, and the second has the characteristic of the triple points propagating dowanstream only with the same velocity,while the dual-headed triple point structure is very complicated.The detonation waves facing upstream and downstream propagate with different velocities, in which the periodic collisions of the triple points cause the oscillation of the detonation wave front. This oscillation process has temporal and spatial periodicity. In addition, the triple point trace are recorded to obtain different cell structures in three sect

Keywords: Oblique detonation wave Wedge Periodic oscillation • Fine structure

Received 2011-03-02; published 2011-07-12

Fund:

The project was supported by the National Natural Science Foundation of China (10872096) and the Open Fund of State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology (KFJJ09-13).

Cite this article:

Ming-Yue Gui, Bao-Chun Fan, Gang Dong.Periodic oscillation and fine structure of wedge-induced oblique detonation waves[J] Acta Mechanica Sinica, 2011,V27(6): 922-928