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Effect of Initial Disturbance on The Detonation Front Structure

HUA-SHU DOU, BOO CHEONG KHOO, National University of Singapore — Effect of initial disturbance on the detonation front structure is studied by 3D numerical simulation. The numerical method used is the high resolution computations using a fifth-order weighted essentially non-oscillatory (WENO) scheme with a third order TVD Runge-Kutta time stepping method. Two types of disturbances are used to give perturbation for the detonation development in a narrow duct. One is the random disturbance which is imposed on the whole front, and another is the symmetrical disturbance, which is inputted within a band along the diagonal direction on the front. The results show that the developing processes of two kinds of disturbances in the detonation are different. For the random disturbance, the detonation front displays a stable spinning detonation. For the symmetrical diagonal disturbance, the detonation front displays a diagonal pattern at the earlier stage, but this pattern is unstable. Shortly, it breaks down and finally it evolves into a spinning detonation. The spinning detonations formed with the two types of disturbances are the same. This means that spinning detonation is the most stable mode for the simulated narrow duct. Therefore, for narrow ducts, implementing spinning detonation is the effect way to realize stable detonation as well as to speed the DDT (deflagration to detonation transition) process.

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