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Detonation Diffraction in Combustible High Speed Flows

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The propagation of detonation in propulsion system is affected by several factors, such as flow before detonation front. In this investigation, the detonation diffraction in T tube with combustible high speed flows were studied numerically for hydrogen/oxygen/nitrogen mixtures using Euler equation with detailed finite-rate chemistry. The fifth-order WENO scheme was adopted to capture the shock wave. The results show that in the downstream direction shock wave decouples from reaction zone due to rarefaction waves, and then couples again by wall reflection. In the upstream direction the detonation wave has some character of oblique detonation due to compression of gas flow. Simultaneously, the triple points trace reveal cellular structure deformed in the flow directions, which is divided into six zones. Depending on flow velocity, in the upstream direction the detonation reinitiation mechanism is categorized into two types: spontaneous reinitiation and reinitiation by reflection.

Keywords: Detonation diffraction, high speed flows, fine structure, cell structure, WENO scheme