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Front Structure of Three-Dimensional Detonations in Gaseous Mixtures BOO CHEONG KHOO, National University of Singapore, HUA-SHU DOU, Zhejiang Sci-Tech University — Numerical simulations have indicated that independent of how the disturbance is imposed at the beginning of the simulations the final stable detonation in a narrow duct is always the spinning detonation with 90 degree phase difference. With a simplified model, the detonation can be described by a process of energy release with a time periodic function corresponding to the motion of transverse waves, and the energy gradient in time can be a source of instability. It is proposed that the most stable energy release is such that the time derivative of energy release is the lowest. In the unsteady detonation, all the detonation structures always tend to approach this stable state. The calculations indicate that for spinning detonation and rectangular detonation in rectangular ducts, the 90 degree phase difference of transverse waves is the most stable and the in-phase detonation is the most unstable. For oblique detonation, the 180 degree phase difference is the most stable and the in-phase detonation is the most unstable. Under a sufficiently large disturbance, the oblique detonation can finally involve into rectangular mode with 90 degree phase difference. These results are in agreement with the numerical simulations and experiments.

Hua-Shu Dou
Zhejiang Sci-Tech University

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