

Interaction between Unsteady Supersonic Jet and Vortex Rings

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Abstract : The unsteady supersonic jet formed by a shock tube with a small high-pressure chamber was used as a simple alternative model for pulsed laser ablation. Understanding the vortex ring formed by the shock wave is crucial in clarifying the behavior of unsteady supersonic jet discharged from an elliptical cell. Therefore, this study investigated the behavior of vortex rings and a jet. The experiment and numerical calculation were conducted using the schlieren method and by solving the axisymmetric two-dimensional compressible Navier–Stokes equations, respectively. In both, the calculation and the experiment, laser ablation is conducted for a certain duration, followed by discharge through the exit. Moreover, a parametric study was performed to demonstrate the effect of pressure ratio on the interaction among vortex rings and the supersonic jet. The interaction between the supersonic jet and the vortex rings increased the velocity of the supersonic jet up to the magnitude of the velocity at the center of the vortex rings. The interaction between the vortex rings increased the velocity at the center of the vortex ring.

Keywords : computational fluid dynamics, shock-wave, unsteady jet, vortex ring

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