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Numerical Investigation of Effects of Angle-of-Attack on a Parachute-like Two-body System

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The supersonic flows around a typical parachute-like two-body system are numerically studied at a freestream Mach number of 2.0. Both rigid and flexible models, composed of a capsule and a canopy, are considered. The objective is to analyse the effects of angle of attack (AoA) on the unsteady flow produced by the parachute-like two-body system and the difference in flow behaviours between the rigid and flexible systems. The following two model configurations are examined for the rigid canopy case: (1) the canopy is connected to the capsule with a rigid rod and (2) the canopy is separate from the capsule. It is found that at a moderate capsule AoA, the most unstable flow field is generated in the interior of the canopy and the connecting rod has a significant effect on the flow field. For the flexible case, the supersonic flows over the model (2) configuration and the canopy alone are investigated. An area oscillation phenomenon is observed in the flexible canopy. When the capsule AoA is increased, the flexible canopy has greater deformation, which results in a lower drag coefficient. The effect of the canopy AoA is also examined for the flexible canopy alone. A small deformation in the canopy shape is observed.

Key words: Compressible flow; Unsteady flow; Two-body system; Fluid-structure interaction; Angle of attack

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