Engineering Applications of Jet Impingement Associated with Vertical Launching System Design

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Abstract

In the course of a missile system design, jet plume impingement is encountered and needs to be analyzed in designing a launcher, requiring careful investigation of its interaction with the system as well as the launcher. In the present paper, numerical results on this complex topic are presented to demonstrate usefulness of CFD in helping design the hardware. The jet impinging flow structure exhibits various forms of such complex nature as shock shell, plate shock and Mach disk whose strengths depending on the flow parameters. The main parameters are the ratio of the jet pressure to the ambient pressure and the distance between the nozzle and the wall. In the current application, the nozzle contour and the pressure ratio are held fixed, but the jet impinging distance is varied to illuminate the characteristics of the jet plume with the distance. The same methodology is then applied to the flow analysis of vertical launcher system (VLS), capturing its flow structure and major design parameters. As a result, the wall pressure level on the bottom of the VLS plenum, the optimum height between the jet exit and the bottom plate and the width of the uptake are determined and manufactured accordingly.

Keyword: *Supersonic Jet Impingement, Plate Shock, Shock Oscillation, CFDS Method, VLS*

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