

Unsteadiness Effects on Variable Thrust Nozzle Performance

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Abstract : The purpose of this paper is to elucidate the flow unsteady behavior for moving plug in convergent-divergent variable thrust nozzle. Compressible axisymmetric Navier-Stokes equations are used to study this physical phenomenon. Different velocities are set for plug to investigate the effect of plug movement on flow unsteadiness. Variation of mass flow rate and thrust are compared under two conditions: First, the plug is placed at different positions and flow is simulated to reach the steady state (quasi steady simulation) and second, the plug is moved with assigned velocity and flow simulation is coupled with plug movement (unsteady simulation). If plug speed is high enough and its movement time scale is at the same order of the flow time scale, variation of the mass flow rate and thrust level versus plug position demonstrate a vital discrepancy under the quasi steady and unsteady conditions. This phenomenon should be considered especially from response time viewpoints in thrusters design.

Keywords : nozzle, numerical study, unsteady, variable thrust

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