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Numerical Simulation of Shock Waves and their Interaction in a Supersonic Rocket Engine Operating at Different Conditions

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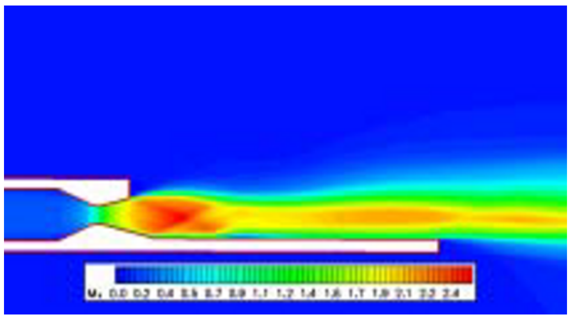
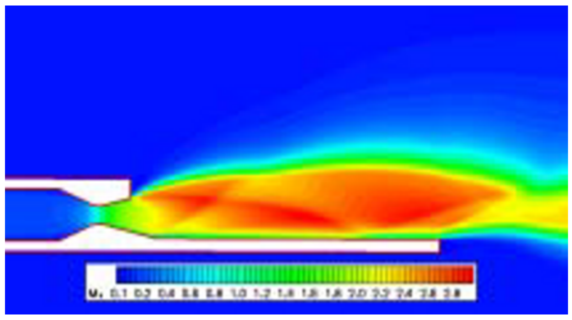
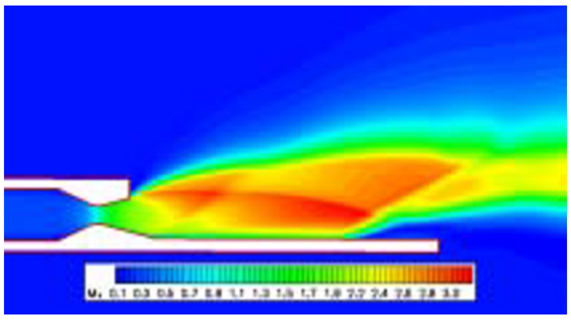


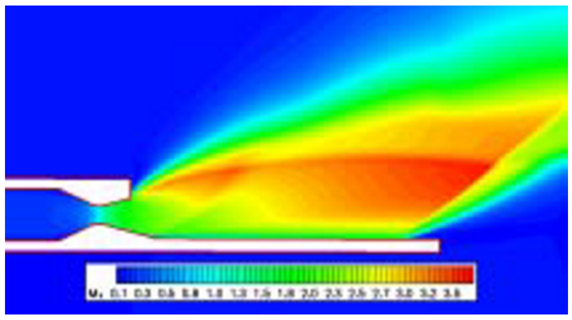
(a) Chamber Pressure = 130 psia



(b) Chamber Pressure = 250 psia



(c) Chamber Pressure = 300 psia



(d) Chamber Pressure = 500 psia

Navier-Stokes numerical simulations showing the supersonic flow field induced by a H2-O2 rocket thruster with an attached panel, under a variety of operating conditions. Mach number distributions demonstrate the structure of the shocks Beyond the nozzle exit. The geometry is asymmetric about the nozzle centerline; and as a result, the shock patterns are not symmetric. The degree of asymmetry in the shock pattern is a function of the velocity of the jet exiting the nozzle. In the case of the psia130 shown in Figure (a), the exit velocity is not high enough to create excessive asymmetry about the centerline of the nozzle. The typical diamond shaped shock pattern still can be recognized. As the chamber pressure and consequently the exit velocity increase, the asymmetry becomes more pronounced to the degree that the shock emanating from the top edge of the nozzle exit is directed away from the panel as is in the case of the psia300 shown in Figure (c) and eventually it is parallel to the flat panel as is in the case of the psia500 shown in Figure (d).