

Analysis of Simple Mechanisms to Continuously Vary Mach Number in a Supersonic Wind Tunnel Facility

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Abstract : Supersonic wind tunnel nozzles are generally capable of producing a constant Mach number flow in the test section of the wind tunnel. As a result, most of the supersonic vehicles are widely designed using steady state flow characteristics which may have errors while facing unsteady situations. This study aims to explore the possibility of varying the Mach number of the flow during wind tunnel operation. The nozzle walls are restricted to be inflexible for cooling near the throat due to high stagnation temperature requirement of the flow to simulate the conditions as experienced by the vehicle. Two simple independent mechanisms, rotation and translation of nozzle walls have been analyzed and the nozzle ranges have been optimized to vary the Mach number from Mach 2 to Mach 5 using minimum number of nozzles in the wind tunnel.

Keywords : method of characteristics, nozzle, supersonic wind tunnel, variable mach number

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