Supersonic Rocket Nozzle Design

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1. Objective:

To design a convergent-divergent rocket nozzle for supersonic flow using isentropic flow theory, create a 2D axisymmetric CAD model, and simulate flow conditions to analyze Mach number, pressure, and temperature variations.

2. Background:

Nozzles in rocket engines are critical components responsible for converting thermal energy into directed kinetic energy to generate thrust. The study of compressible, isentropic flow in nozzles allows prediction of performance characteristics such as Mach number distribution and exit pressure. This project applies these principles to a single-stage, supersonic nozzle with a design Mach number of 2.6.

3. Methodology:

Table 1. Input Parameters

Parameter	Value
Chamber Pressure	3 MPa
Exit Pressure	101325 Pa
Chamber Temperature	3500 K
Specific Heat Ratio	1.22
Gas Constant	287 J/kg·K
Throat Diameter	20 mm

Exit Mach Number = 2.62
Area Ratio = 5.32
Exit Diameter = 46.3mm
Nozzle Length(conical, 15°semi-angle) = 99.2mm