ABSTRACT

This report aims to describe the study of internal flow in a Convergent Divergent Nozzle for application in a Supersonic/Hypersonic propulsion system. The Convergent Divergent Nozzle plays an important role in accelerating internal flows to achieve design conditions while producing numerous flow patterns in choked condition. The primary objective of this analysis is to correlate the performance and effectiveness of the Nozzle geometry and plot the contours of static pressures, temperatures, stagnation properties and velocity along the length of the diverging section of the nozzle. The oblique and normal shockwaves are captured and studied & the subsequent pressure and velocity profiles are recorded. Mesh independent study is performed to deduce accurate and precise results.

PROBLEM STATEMENT

For a steady state turbulent flow, analyze the internal flow in a Convergent Divergent model (Figure 1). (The Nozzle geometry and dimensions are assumed). Use a suitable turbulence model. Include the calculation of the aerodynamic coefficients. Now perform the same set of calculations for a converging nozzle and compare the efficiencies of both the geometry for the same boundary conditions.

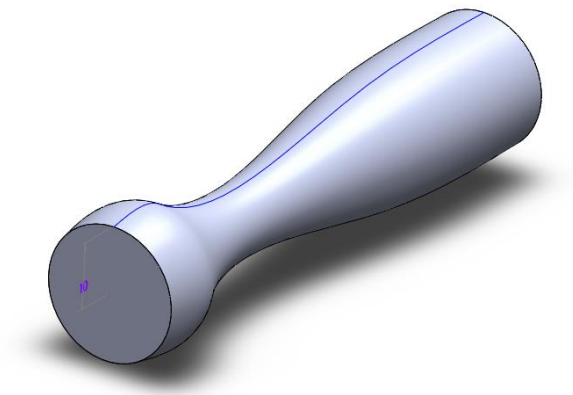

Figure 1

Following are the conditions that you will need to solve the problem

M (inlet) = 0.3

Stagnation Pi (atm) = 1 atm

Stagnation Temperature To = 1100 K

Density (air)= 1.225 kg/m3

Back pressure is the variable , Conduct a mesh independent study and for the 2nd run consider a Normal Shock at the exit.