

ABSTRACT

The following report describes the study of a non-reacting supersonic flow field in a scramjet combustor with a single cavity flame holder. Cavity plays a significant role in scramjet combustors to enhance mixing and flame holding of supersonic streams. The primary aim of this analysis is to compare the performance of the two cavities and plot the contours of static pressure, static temperature, total pressure and x-velocity along the cavity length. k- ϵ Turbulence model captures the shock waves and combustion distinctly and clearly. So the shock waves affect the pressure and velocity profiles. Also, the flow properties at the outlet are noted for each case. Mesh independent study is done to get accurate results for the analysis of the flow.

PROBLEM STATEMENT

For a k- ϵ Turbulence model flow, perform a CFD analysis on non-reacting supersonic flow airflow in a scramjet combustor with rear wall-expansion cavity flame holder for the geometries given below using openfoam. Generate plots of pressure and velocity and observe the change in the shear layers and recirculation zone. Find the flow properties at the outlet of the combustor.

BOUNDARY CONDITIONS:

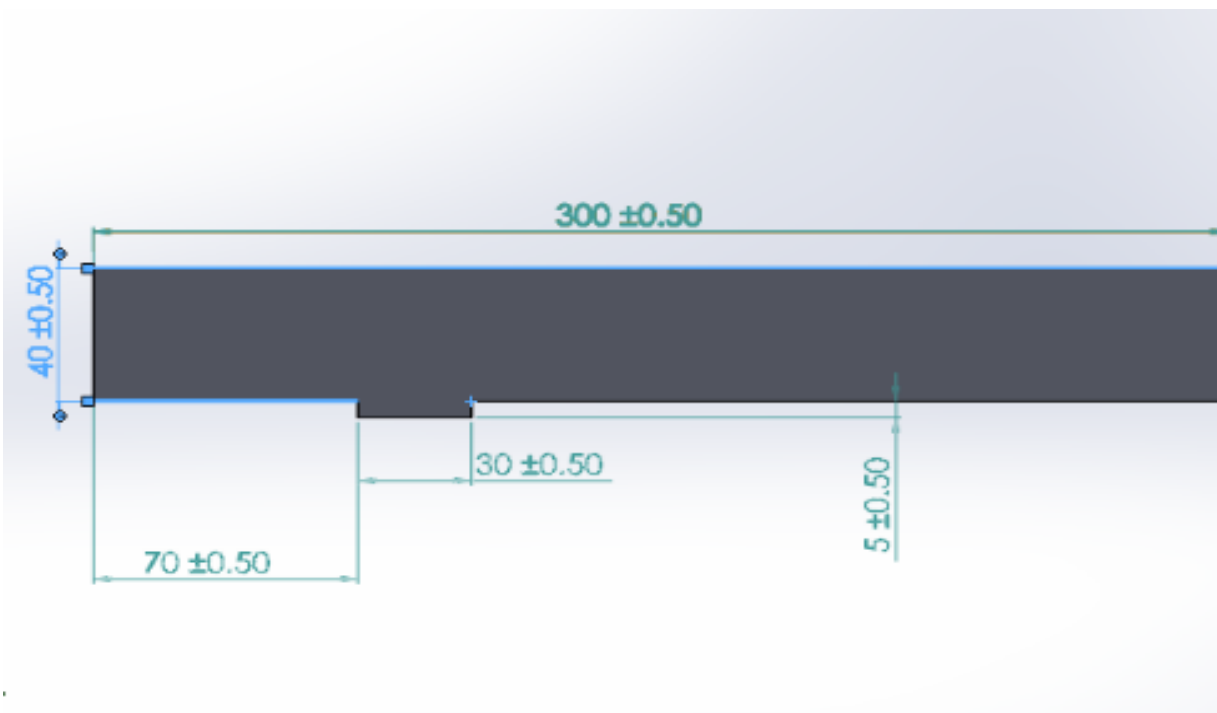
The initial conditions at the inlet are as follows:

Mach number, $M=2$

Stagnation pressure, $P_0=7$ atm

Stagnation temperature, $T_0= 1100$ K

Basic dimensions of the scramjet combustor



Geometry 1



Geometry 2

