Comparison of LES and RANS Turbulence Models for Flow in a Scramjet Combustor without Fuel Injection

Mridu Sai Charan A S[1]

[1]Undergraduate Student, Mechanical Engineering Dept., PES University, Bangalore, 560073
contact: mridusai@hotmail.com

Abstract

This case study aims to simulate air flow, i.e., without hydrogen injection, in a SCRAMJET Combustor. The combustor geometry is similar to the experimental setup used by The DLR (German Aerospace Center) [1]. It includes a wedge shaped flame holding structure at the base of which, fuel injectors are present. The combustor is a one-sided diverging section beyond the strut Figure (1). As a means of validation, the numerical results from the study are compared with experimental research conducted by the DLR. Qualitative differences are brought between numerical and experimental schlieren images. In addition, a study on turbulence models is also conducted to investigate the robustness of each model for this particular case.

The solver used is the sonicFoam solver. Turbulence models that are used in this comparative study are:

- Spalart Allmaras

- $k - \varepsilon$

- $k - \omega$ SST

- Large Eddy Simulation (LES)

    - $k - Equation$
    - $Smagorinsky$

- Detached Eddy Simulation (DES)

    - $k - \omega$ SST DDES
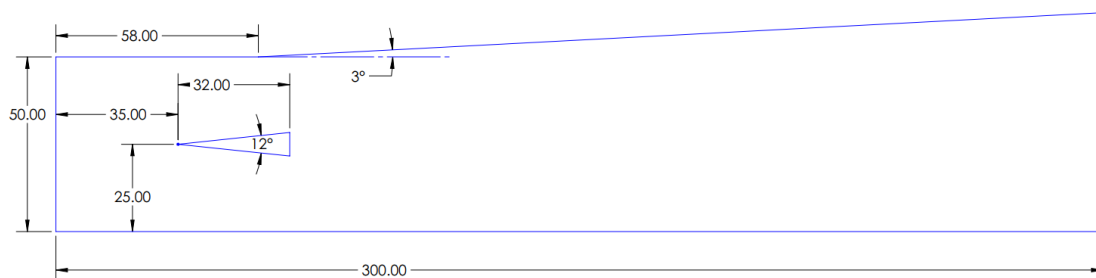   - Spalart Allmaras DDES

Figure 1: Schematic of the Computational Domain

References

[1] Waidmann, W and Brummund, U and Clauss, W and Oschwald, M (1994). *Experimental investigation of the combustion process in a supersonic combustion ramjet (SCRAMJET)*. DLR Project Report.