7. Conclusion

By this Analysis we can conclude the "K epsilon turbulence model exactly simulates the flow field characteristics in supersonic and hypersonic conditions" in capturing shocks at leading edges and shock trains in the isolator. Supersonic flow from a nozzle that represents the exhaust nozzle of a supersonic combustion ramjet (SCRAMJET) is modeled using ANSYS Fluent. Jet from the nozzle is issued into a domain which is bounded on one side by an afterbody wall which is parallel to the centerline of the nozzle. Shocks propagating from the nozzle exit reflect from the afterbody. Measured values of (i) the distribution of wall pressure and (ii) heat transfer rate along the afterbody are used to validate the CFD simulation. It is interesting to note that obtaining experimental pressure measurements was a quicker process than CFD modeling in terms of both overall time taken and the time to investigate each configuration. However, CFD generates a much larger number of flow parameters than can be experimentally determined and is significantly less expensive, in terms of both personnel and equipment, than performing experiments in the shock tunnel. Simulation has been validated for a two-dimensional scramjet outlet flow. In particular, we compared pressures and heat transfer on the afterbody for 0-degree and 20-degree configurations.

8. Future Work

The first of these is that analyzing three dimensional scramjet and the next is application of a fully designed expansion system employing the use of method of characteristics or CFD codes. This will enable more precise calculations of performance, as well as provide more realistic overall engine lengths to be obtained, as the nozzle does not have to be fully expanded to free stream conditions to gain a satisfactory amount of thrust. As for the practical design of this scramjet, the use of cavity-based fuel injectors should be explored.

This project looked at a two dimensional model of the Scramjet exhaust. The logical extension to this would be to use a three dimensional model, Also the shock waves produce on the side walls could be captured. Three dimensional models would be impractical unless a CFD package with shock-capturing features could be used.

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