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Author: Mr. Greekshith Mahesh Babu
R V College of Engineering, Bengaluru, India, greekshith@gmail.com

Mr. Solomon D'Costa
R V College of Engineering, Bengaluru, India, solomondcosta201@gmail.com
Mr. Satej Patil
R V College of Engineering, Bengaluru, India, satejpatil.ae21@rvce.edu.in
Mr. Chyawan Chandrashekar
R V College of Engineering, Bengaluru, India, chyawanc@gmail.com
Mr. Vageesha Sharma
R V College of Engineering, Bengaluru, India, vageeshasharma13@gmail.com

STRUCTURAL MODIFICATION AND FLOW ANALYSIS OF ISOLATOR FOR ENHANCED EFFICIENCY OF DUAL MODE RAMJET-SCRAMJET ENGINE

Abstract

The dual mode ramjet-scramjet engine is an ingenious piece of technology that can potentially revolutionize flight at hypersonic speeds. However, the designs of these engines as of today are not as efficient as they could be. A ramjet engine operates at supersonic speeds around Mach 3 and a scramjet engine operates at hypersonic speeds, which could theoretically reach Mach 12. Both of them aren't as efficient at lower speeds, which can hinder operational efficiency. The dual mode engine solves the inefficiency issue at lower speeds by enabling the transition from one mode to another. This feature makes it an appealing choice for hypersonic vehicles that experience different flight conditions, such as hypersonic cruise above Mach 5, requiring an engine that can operate efficiently at both supersonic and hypersonic speeds. The goal of this research paper was to improve the efficiency of the dual mode ramjet-scramjet engine, and the method employed to do this was to modify the structure of the isolator and analyze the flow inside it. The concept of shock normalization was explored to make the needed modifications to the isolator. ANSYS Fluent was used to simulate the flow in the isolator of the engine. Different ranges of velocities within Mach 3 to Mach 9 were used to analyze the performance of the engine. The improvement in efficiency of the new model, which was developed over an already existing experimental setup, was evaluated, while maintaining the same initial conditions, which provided a comparative study. The engine isolator modifications coupled with the flow analysis culminated in the creation of a more effective dual mode ramjet-scramjet engine. This research paper's findings have a critical role to play in the growth and advancement of engines with superior efficiency for subsonic, supersonic, and hypersonic flights. By improving the efficiency of dual mode ramjet-scramjet engines, this study has the capacity to facilitate swifter and cost-effective hypersonic flight for military and commercial applications, making it a significant contribution to the field.