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IAF SPACE PROPULSION SYMPOSIUM (C4)
Hypersonic Air-breathing and Combined Cycle Propulsion, and Hypersonic Vehicle (7)

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OPTIMISED INLET DESIGN FOR HYPERSONIC FLIGHTS

Abstract

The demand for cutting-edge technology in the propulsion system is of prime importance nowadays in the aerospace industry. In the last two decades, a large effort has been made over research in the hypersonic regime. Mostly the research in this field has been done based on the applications mainly related to military systems and High-speed air breathing propulsion. The high-speed air breathing propulsion cycle with the rocket engine is used to improve the average specific impulse with the trajectory which is a possible way for applications like launchers and further used in the reusable launch vehicles. Every scramjet engine requires some initial additional propulsion for the acceleration. In the scramjet engine, the initial compression is totally dependent on the type of inlet used which is responsible for the slowdown of air alongside increasing pressure without any compressor which also removes the need for a turbine or any kind of turbomachinery component. The scope of this paper is to design the inlet which is capable of operating in the hypersonic regime. Hypersonic inlets are designed on the basis of shock analysis which helps in compression of air above Mach 5. The inlet design is optimized based on reducing the flow spillage and thus, inlet efficiency has been increased. The design has been done based on the extensive literature survey and the current ongoing available research thus, further optimizing the engine performance. Further, the boundary layer for the hypersonic inlet has been analyzed based on temperature variations. Design and optimization of the inlet and simulation will be done by considering various shocks associated with this regime like normal and oblique shocks. Hypersonic shocks and boundary layer interaction can be done with professional software. Further, the material selection poses a great challenge for the hypersonic intake manufacturing, thus, the selection of materials has been done based on the material properties and available literature survey. In this paper, we explain the essential properties of the hypersonic intake that are required while counter strike and why they are important. Further optimization in traditional thermal protection system for hypersonic missiles or vehicle to advance thermoelectric material which will lead to surplus thrust generation. These days advanced material like woven silicon carbide ceramic composites which can bear the temperature in the range of 2000'C are studied for the hypersonic regime.