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Computational Analysis of Variation in Thrust of Oblique Detonation Ramjet Engine With Adaptive Inlet

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Abstract : IN THE MODERN-WARFARE ERA, THE PRIME REQUIREMENT IS A HIGH SPEED AND MACH NUMBER. WHEN THE MISSILES STRIKE IN THE HYPERSONIC REGIME THE OPPONENT CAN DETECT IT WITH THE ANTI-DEFENSE SYSTEM BUT CAN NOT STOP IT FROM CAUSING DAMAGE. SO, TO ACHIEVE THE SPEEDS OF THIS LEVEL THERE ARE TWO ENGINES THAT ARE AVAILABLE WHICH CAN WORK IN THIS REGION ARE RAMJET AND SCRAMJET. THE PROBLEM WITH RAMJET STARTS TO OCCUR WHEN MACH NUMBER EXCEEDS 4 AS THE STATIC PRESSURE AT THE INLET BECOMES EQUAL TO THE EXIT PRESSURE. SO, SCRAMJET ENGINE DEALS WITH THIS PROBLEM AS IT NEARLY HAS THE SAME WORKING BUT HERE THE FLOW IS NOT MUCH SLOWED DOWN AS COMPARED TO RAMJET IN THE DIFFUSER BUT IT SUFFERS FROM THE PROBLEMS SUCH AS INLET BUZZ, THERMAL CHOCKING, MIXING OF FUEL AND OXIDIZER, THERMAL HEATING, AND MANY MORE. HERE THE NEW ENGINE IS DEVELOPED ON THE SAME PRINCIPLE AS THE SCRAMJET ENGINE BUT BURNING HAPPENS DUE TO DETONATION INSTEAD OF DEFLAGRATION. THE PROBLEM WITH THE ENGINE STARTS WHEN THE MACH NUMBER BECOMES VARIABLE AND THE INLET GEOMETRY IS FIXED AND THIS LEADS TO INLET SPILLAGE WHICH WILL AFFECT THE THRUST ADVERSELY. SO, HERE ADAPTIVE INLET IS MADE OF SHAPE MEMORY ALLOYS WHICH WILL ENHANCE THE INLET MASS FLOW RATE AS WELL AS THRUST.

Keywords : detonation, ramjet engine, shape memory alloy, ignition delay, shock-boundary layer interaction, eddy dissipation, asymmetric nozzle
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