SPACE PROPULSION SYMPOSIUM (C4)
Hypersonic and Combined Cycle Propulsion (9)

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COMPUTATIONAL INVESTIGATION OF EFFECT OF CONVERGING-DIVERGING NOZZLE (C-D NOZZLE) ON THE PERFORMANCE OF PULSE DETONATION ENGINE(PDE)- EFFECTS ON THRUST AND INLET PRESSURE

Abstract

Detonation is a process of combustion in which a supersonic shock wave is propagated through a fluid due to an energy release in a reaction zone. A pulse detonation engine (PDE) is a new concept engine which produces thrust by generating detonation intermittently. PDE produces a higher specific thrust than comparable ramjet engines at speeds suitable for use as part of a multi-stage propulsion system. It can also be used to reduce the cost and complexity of launching spacecraft. The performance of a Pulse Detonation Engine (PDE) can be strongly affected by the shape of the tube wall, of which it is essentially comprised, this is clear if the Fluid dynamics nature of the device is considered and has been studied out in computational investigation. Most of these investigations have focused on the aft end of the PDE and have therefore been called nozzle studies. In fact, the phrase "nozzle", usually associated with gas expansion processes, may be somewhat misleading in the PDE since it is not yet clear whether the changes in performance arise due to the expansion or the compression and/or detonation processes in area varying regions. The theoretical analysis of nozzle effects is difficult due to the unsteady features of pulse detonation engines, so the computational method is considered here. Bell-shaped nozzles were found to be better at performance enhancement. The converging–diverging nozzles produced the highest performance enhancement comparing with other kind of nozzles. The number of converging–diverging nozzles has been investigated, because it is hard to conclude that the best nozzle for a pulse detonation engine. There is still work to be done to establish the design rules for a pulse detonation engine nozzle. Therefore the effect of bell-shaped converging–diverging nozzles on the performance enhancement of a pulse detonation engine was studied here.