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Author: Mr. Linsu Sebastian
University of Petroleum and Energy Studies, India

Dr. Ugur Guven
United States

EFFECTS OF DIFFERENT TYPES OF DIVERGING NOZZLE ON PROPULSION PERFORMANCE OF CONTINUOUS DETONATION ENGINE (CDE)

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 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. But there are several drawbacks that need to be overcome in PDE. PDE is difficult to achieve high operational frequency resulting consequently in low mass flux, also high ignition energies are needed for each pulse cycle making ignition difficult. Recently, researchers are working in developing a detonation engine operating without need of periodic ignition and continuously injecting fuel would greatly reduce difficulties in designs of, in particular, detonation combustion aerospace thrusters. Continuous Detonation Engine (CDE) (also known as Rotating Detonation Engine (RDE)) is simulated recently, which is expected to meet the above demands. The rotating propagation of a continuous detonation engine (CDE) with different types of C-D nozzles is investigated using Computational Fluid Dynamics Software. In this paper, detailed analyses of the propulsion performance of a CDE with different types of Diverging nozzle with constant area nozzle is compared. The gross thrust, the fuel mass flow rate per square meter, the gross specific impulse not including the momentum of the incoming gas, and the net specific impulse are calculated using a computational analysis to study the propulsion performance for different configuration of Diverging nozzle design. The gross thrust, the fuel mass flow rate per square meter, the gross specific impulse not including the momentum of the incoming gas, and the net specific impulse are calculated using a computational analysis to study the propulsion performance for different configuration of Diverging nozzle design.