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ELECTRO-CHEMICAL THRUSTERS: A NOVEL DESIGN FOR ADVANCED PROPULSION

Abstract

Gas turbine propulsion is a phenomenon of practical and functional significance and covers wide range of applications including power generation, transportation, military/safety purposes, rescue operations and space research applications. A gas turbine engine essentially is an internal combustion engine which produces power by controlled burning of chemical fuel and is widely known as Chemical Propulsion. Appreciable work (experimental, numerical, analytical) had been done to which have contributed immensely to make human life easier under diverse conditions and needs. The base of jet propulsion rests on standard equations (Newton's laws) and depends upon the role and utility of controlling parameters which are interdependent (thrust, exit velocity,specific impulse). However,there are physical constrains which prevent the chemical mode of propulsion like weight, fuels, materials atmospheric conditions, altitude and integration complexities. The rapid development in space propulsion have invited wide-ranging options which are still in developing stages solar,nuclear,magnetic etc. The electric propulsion is a promising mode which works by using electric energy to accelerate a propellant to much higher velocities than is possible using chemical. It involves ionizing a gas to plasma which is emitted at very high speed as exhaust.Electric thrusters typically use much less propellant than chemical mode because they have a higher exhaust speed (operate at a higher specific impulse) than chemical mode. Electric propulsion can achieve high speeds over long periods and thus can work better than chemical mode depending on flexibility, safety, cost, maintenance cost, and use of propulsion power, etc. In recently, with air breathing propulsion, there is varying need under assorted conditions and requirements which necessitates to be addressed. The present work endeavors to understand the issues with jet propulsion concerning current requirements and is an attempt to address the same by inducting electric propulsion as an additional component. Through proper conducting, a novel design for an ELECTRO-CHEMICAL thruster is proposed and the feasibility and spontaneity of the design is theoretically tested under varying conditions. This configuration is very likely to have significant implications on flow features which can be controlled for required output. With the inclusion of present design the engine can be shifted to chemical or electrical propulsion mode based on requirement. It is expected that benefits of electric propulsion can minimize the loopholes in simple chemical propulsion. The specific objectives of the work are: a)To investigate the effectiveness of a potential ELECTRO-CHEMICAL thruster under varying conditions. b)To analyze the role of key controlling parameters.