



## THRUST CONTROL OF AN ELECTRIC PROPULSION SPACE VEHICLE WITH MINIMAL FUEL CONSUMPTION

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**ABSTRACT**—The objective of this research is to develop a heuristic process to obtain a near optimal control strategy for an electric-propulsion spacecraft. The work reported here in particular uses a genetic algorithm (GA) to develop a control profile for an ionic thruster for a spacecraft such as the Jupiter Icy Moons Orbiter (JIMO), although the methodology could be used for any deep-space mission using ionic thrusters. The spacecraft's mission is to travel between two points in space with high fuel efficiency, to intercept the target at the end of the predefined time frame with a predefined velocity, and to satisfy certain constraints on thrusting or coasting duration. Control strategies are represented as chromosomes, and a GA is used to find the best chromosome among the candidate solutions. By using intermittent low thrusts, simulations have JIMO satisfying mission objectives. The fitness function used to obtain the control strategies minimizes the final-state error and the fuel consumption; this function is simple and effective. The final, comprehensive control strategy, however, is sensitive to the under-performance of JIMO's propulsion system, indicating how critical the performance of JIMO's engine and actuator is for the outcome of the mission.

**Key Words:** Genetic Algorithm, Minimal Fuel, Control System, Electric Propulsion, Open Loop