52nd IAF STUDENT CONFERENCE (E2)
Student Conference - Part 2 (2)

Author: Mr. Jared Orrick
University of Manchester, United Kingdom

ELECTRIC PROPULSION SYSTEM SIZING FOR MARTIAN ROTORCRAFT

Abstract

NASA's Ingenuity Mars helicopter determined the feasibility of rotor-powered flight in the challenging Martian environment. This groundbreaking achievement has significantly expanded the potential for the exploration of Mars through the use of rotorcraft, and conceptual designs have been proposed to follow Ingenuity. To improve the next generation of Martian rotorcraft it is essential to understand the challenges and design principles of electric propulsion system components suitable for flight on Mars. This paper presents a sizing method for the application of electric propulsion systems specifically tailored for the Martian environment based upon given input parameters and design constraints. The sizing algorithm employed utilises blade element momentum theory to model the hover performance of a given rotor, and empirical relationships based upon existing data are used to estimate the mass and respective characteristics of the rotor, motor, electronic speed controller, battery, and solar panel. The results obtained from the sizing algorithm are validated using data from Ingenuity to confirm its suitability for Martian rotorcraft design. It is shown that the rotor performance modelling method achieved an accuracy within approximately 3