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DESIGN AND DEVELOPMENT OF A BUTANE WARM GAS PROPULSION SYSTEM FOR 6U
CUBESAT;

Abstract

CubeSats" missions are becoming more complex and sophisticated, necessitating onboard propulsion systems in these types of spacecrafts. Most satellite propulsion technologies are intricate, expensive, and difficult to implement without a lot of ground support resources. These techniques may be workable for major commercial or government initiatives, but it cannot be employed for miniaturized satellites. In contrast to the conventional propulsion systems on larger spacecraft, there is a different emphasis on CubeSats. The systems must be affordable, low volume, and secure. This paper presents a novel two-phase propellant-based (Liquid/Gas) Propulsion System for small satellites developed by YahSat Space Laboratory at Khalifa University (KU). Butane (C₄H₁₀) is used as the working fuel in the warm gas propulsion class developed system. In order to extend the mission life and enhance the system performance, a heating element was included in the thruster design. The heating element increases the propellant temperature to achieve a higher exhaust velocity. The analysis shows that using approximately 300 gr of butane contained in a cylindrical propellant tank will allow the CubeSat to meet the mission requirement. The study demonstrates that selecting a nozzle design with a 300 aspect ratio will yield the needed thrust of 25 mN. The resulting specific impulse of such configuration is approximately 80 sec.