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SURVEY AND PERFORMANCE ANALYSIS OF CHIPSAT PROPULSION CONCEPTS

Abstract

ChipSats are a revolutionary concept pushing the boundaries of spacecraft size to its extreme lower limit. This will enable production and deployment of capable space systems at extremely low prices. Architectures based around distributed swarms of ChipSats have been proposed for several application cases, including scientific investigation of Earth's upper atmosphere and exploration of asteroid and other small solar system bodies. Many of these applications would benefit from the use of propulsion to distribute ChipSats within the swarm and maintain their relative positions.

Propulsion system design for ChipSats presents challenges that are distinct from those faced by larger spacecraft. The scale of such systems precludes typical propulsion systems based on propellant use, so innovative propellantless propulsion concepts must be pursued. The low mass of ChipSats presents an opportunity to leverage small scale forces to large effect. Several past papers have proposed potential propulsion solutions, however these papers have typically been focused on ChipSats broadly and have given little attention to characterizing or comparing the performance of different propulsion options. This paper aims to remedy this by first developing initial performance estimates for each of the most promising ChipSat propulsion concepts, then conducting a comparison of the suitability of each option for several potential ChipSat propulsion use cases.