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APPLICATION OF AUTOPHAGE ROCKET PROPULSION TO HIGH THRUST IN-SPACE TRANSPORTATION: A PERFORMANCE AND FEASIBILITY ANALYSIS

Abstract

Autophage propulsion has primarily been investigated for space launch applications due to its potential to reduce structural mass. This study explores its feasibility for in-space propulsion, considering differences in mission parameters such as vehicle scale, duration, space environment, and thrust profile.

A system-level performance model is developed for an autophage thruster applied to a reference space tug or orbital transfer vehicle. The mass efficiency is compared to state-of-the-art propulsion systems, including bi-liquid and electric thrusters, to assess the benefits of hybrid autophage propulsion. Due to the absence of inert tank walls, mass advantages increase with mission ΔV, while initial structural aspect ratio influences engine mass and propellant feed power requirements.

In contrast to launch applications, the in-space environment and thermomechanical load case impose different constraints on the combustible fuselage, affecting material selection and manufacturing processes. This study examines feasible materials — primarily thermoplastics — and their processing requirements. Operational challenges unique to in-space use are discussed based on a literature review and preliminary development steps by Alpha Impulsion.