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EROSION IMPACT ON THRUST ALIGNMENT IN HYBRID ROCKET MOTOR NOZZLE EXTENSIONS USING VARIOUS MATERIALS

Abstract

Material selection for nozzle extensions in hybrid and solid rocket motors differs from self-cooled liquid-based ones. Ceramic matrix composites, refractory metals, and alloys are distinctive by their high-temperature mechanical durability. Since the thrust misalignment could be triggered in space by nonhomogeneous erosion; homogeneity and rate of erosion is critical.This study aims to integrate the nozzle extension to polymeric fuel-based hybrid rocket motor for space applications.By implementing carbon-carbon, silica phenolic and metallic materials; 3D nozzle efficiency and area ratio -Mach number relationship in sea-level will be investigated.CFD analyses will be applied to nozzle extensions, afterwards they undergo 3D scanning to observe erosion results. Results will be compared based on CFD analyses, also erosion characteristics throughout the extensions will be evaluated in terms of thrust misalignment.