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THE GUIDANCE PROBLEM OF SIDEREUS SPACE DYNAMICS' INNOVATIVE
SINGLE-STAGE-TO-ORBIT VEHICLE: A DIRECT TRANSCRIPTION APPROACH

Abstract

This paper offers a detailed mission analysis for Sidereus Space Dynamics' innovative Single-Stage-to-Orbit vehicle, EOS, focusing on its capability to deploy small satellites into specifically beneficial orbits. Employing a direct transcription method, the study aims to maximize the vehicle's payload capacity and validate its design for precise orbital delivery. The core objective of the mission is to achieve a 550 km altitude Sun-Synchronous-Orbit, enabling the delivery of 10 kg payloads optimized for small satellite operators. The analysis addresses significant aerostructural challenges associated with designing an ultralight vehicle. Such challenges are pivotal as they impact the vehicle's dynamic stability and integrity during launch and orbit insertion. Our findings confirm the EOS vehicle's ability to meet these stringent requirements robustly and achieve the targeted orbit efficiently. The study underscores the vehicle's theoretical and practical readiness, illustrating its potential to revolutionize near-Earth space affordability and accessibility for small satellite missions.