Modeling Lattice Fins as Flight Control Surfaces for a Precision Guided Landing of Reusable Rockets Continuation Study

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The proliferation of reusable rockets has driven expenses down and launch frequencies up completely reshaping the space exploration industry. A critical component of this sustainable technology is in the Flight Control Surfaces (FCS) of these reusable rockets in the form of lattice grid fins. Using computer-aided design, four novel lattice fin designs were produced and attached to a rocket booster. Each fin was oriented at varying angles of attack (AOA) to analyze the comprehensive behavior of the FCS. Four models were created; Model 1 is the most advanced design currently operated by the industry and Models 1, 2, and 3 have never been tested. The force moment (torque) on each rocket model will be recorded to quantify the torque delivered to the rocket by each grid fin and AOA. Force coefficient plots were calculated using a Computational Fluid Dynamics (CFD) wind tunnel website simulation for an exhaustive analysis. An FCS with a relatively higher force moment consistent over different AOA characterizes a superior design for rocketry. Model 3 outperformed every model including the industry's most advanced design, Model 1. Implementing these superior FCS on reusable rockets and precision guidance systems will save upwards of millions of dollars in expensive propellant and auxiliary launch expenditures. More advanced FCS on rockets stimulates discovery on the final frontier and supports the United Nations Sustainable Development Goal 9 for industry, innovation, and infrastructure.