

Experimental Analysis of Redesigned Aerospike Nozzles for Enhanced Performance

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Abstract

The redesigned aerospike nozzles were analyzed parametrically and experimentally in this paper. Rocket propulsion systems, in particular, benefit from having aerospike nozzles that also can perform at higher altitudes. Nonetheless, the intricate flows across components and their thermal management enclosures yield design innovations. The aerospike nozzle geometries are required to be re-modeled and the investigation focuses on parametric modifications with respect to flow, shocks, thermal efficiency etc. Computation In this way performance of these configurations is analysed based on pressure distribution & variation in Mach number and thrust efficiency. The goal is to reduce its energy consumption by half while realizing the actual thermal efficiency with CFD models. Additional wind tunnel experimental results confirm the simulation findings and provide a field-to-field comparison in detail between conventional aerospike designs and these redesigns. In this sense, the study argues that it is more efficient and effective in thrust-to-weight ratio than conventional aerospike nozzles with better altitude control, providing a new reference for future space and aerospace applications. Thus, this investigation represents the continuation of ongoing progress in aerospike technology by elucidating changes to geometry affecting nozzle efficiency and will perhaps lead these aerospikes into future rocket engines that are more efficient.

Keywords

Aerospike nozzle, altitude compensation, rocket propulsion, computational fluid dynamics (CFD), experimental analysis.