Paper ID: 60843
student

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Virtual Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (VP)

Author: Mr. Irving Enrique Gomez Fernandez
Mexico

PROPULSION SYSTEM OF A NANOLAUNCHER BASED ON AEROSPIKE NOZZLE TO SEND CUBESATS FROM MEXICO

Abstract

The frame system, the payload, the guidance system and, last but not least, the propulsion system are the four crucial elements to all kinds of rockets. Continuing the work titled "Conceptual design of a nanolauncher based aerospike nozzle to send CubeSats from Mexico " in this paper we focused, mainly, on the propulsion system of our small rocket. The conceptual design proposal of the nanolauncher has an Annular Aerospike nozzle to the first stage, and a Laval nozzle to the second stage. The propulsion system includes all the parts which make up the rocket engine: Tanks, pumps, power head, propellants and a combustion chamber with nozzle. After we laid the foundations of the aerospike nozzle conceptual design proposed in the paper mentionated, we kept working on an annular type design, due to its lower complexity compared to a linear aerospike nozzle. The main advantage to the annular aerospike nozzle is the altitude compensation relation at its design altitude parameter. In specific words, the aerospike will not suffer from the save overexpansion losses that a bell nozzle suffers and can operate near optimally, giving the highest performance possible at every altitude up to design altitude proposed. A Computational Fluent Design Analysis to optimize the aerospike nozzle set performance was realized. We used different materials, on the one hand alloys Aluminum Al 6061 and Al 7075 are used to provide an optimized STIFFNESS; on the other hand, the Carbon Fiber Reinforce is used to consider weight reduction and to provide better STRENGTH to high temperatures. Regarding the propellants, we decided to use a solid rocket engine due to the dimensions and weight of the rocket. The propellant grain was processed with a Multi Fin core shape which has an influence on the thrust curve; since the first range, a higher thrust is reached that results in an optimum performance for the altitude compensation relation of the design parameters. In brief, the major function of the propulsion system is to generate Thrust. Based on our first design parameters and initial conditions by the Computational Fluent Simulation Results, we expected to get an optimum thrust to elevate the mass of the nanolauncher between 100-200 kg, to release the 3U CubeSat into a Low Orbit Earth above 200 km.