Paper ID: 53736
oral
student

IAF SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Technology (3) (10)

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COLD GAS EXPERIMENTS ON LINEAR, THRUST-VECTORED AEROSPIKE NOZZLES THROUGH SECONDARY INJECTION

Abstract

Within the ACTiVE-project, numerical and experimental investigations are conducted at TU Dresden concerning aerospike nozzles with thrust vector control through secondary fluid injection. An integral part of this project is a cold-flow test bench with a six degree of freedom (6-DOF) force measurement set up. This test bench is mounted into a vacuum chamber to achieve higher pressure ratios between chamber (up to 1MPa) and ambient (down to 5kPa).
This contribution covers the methodology for 6-DOF force measurement tests as well as the results from the pre-test campaign. It starts with the argumentation for choosing the investigated nozzle and thrust vector control method. A detailed presentation of the experimental set up follows in terms of the test bench used at TU Dresden and additional optional measurement equipment, e.g. a background oriented Schlieren (BOS) set up. Subsequently, the development of the test specimen is described, starting with the rough dimensioning followed by the nozzle contour and secondary injection port design. The specimen is constructed modularly, allowing a fast replacement of the additive manufactured nozzle which enables a fast iteration of its geometry, e.g. the truncation length, position and angle for the secondary gas injection etc. A presentation of the results from the pre-test campaign follows for steady state in over-expanded, adapted and under-expanded conditions as well as transient flows.
This research project is funded by Sächsische Aufbaubank (SAB) with money from the Ministry of Science and Arts of the State of Saxony. It is embedded in the ambitious endeavour at TU Dresden to establish a profound base of knowledge for aerospike nozzles with thrust vector control through secondary fluid injection.