

A Single Stage Rocket Using Solid Fuels in Conventional Propulsion Systems

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Abstract : This paper describes the research investigations orientated to the starting and propelling of a solid fuel rocket engine which operates as combined cycle propulsion system using three thrust pulses. The vehicle has been designed to minimise the cost of launching small number of Nano/Cube satellites into low earth orbits (LEO). A technology described in this paper is a ground-based launch propulsion system which starts the rocket vertical motion immediately causing air flow to enter the ramjet's intake. Current technology has a ramjet operation predicted to be able to start high subsonic speed of 280 m/s using a liquid fuel ramjet (LFRJ). The combined cycle engine configuration is in many ways fundamentally different from the LFRJ. A much lower subsonic start speed is highly desirable since the use of a mortar to obtain the latter speed for rocket means a shorter launcher length can be utilized. This paper examines the means and has some performance calculations, including Computational Fluid Dynamics analysis of air-intake at suitable operational conditions, 3-DOF point mass trajectory analysis of multi-pulse propulsion system (where pulse ignition time and thrust magnitude can be controlled), etc. of getting a combined cycle rocket engine use in a single stage vehicle.

Keywords : combine cycle propulsion system, low earth orbit launch vehicle, computational fluid dynamics analysis, 3dof trajectory analysis

Conference Title : ICSRPPT 2021 : International Conference on Solid-Propellant Rockets and Propulsion Technology

Conference Location : Sydney, Australia

Conference Dates : December 02-03, 2021