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EXPLORING TRIANGULAR PRISM BODY ROCKET FOR RUNWAY LANDING

Abstract

Reusability is the key to space exploration and has been a hot topic since the beginning of the decade, today a Falcon 9 can carry crew to the international space station while being fully reusable for several future missions. The paper represents a design of a completely reusable and efficient first stage which is specifically designed to land like an airplane and comparing it with retro propulsion landing and catching the stage midair. Since the primary purpose of the design is efficiency, landing the stage without extra retro propulsion is the solution here, and to land it effectively the shape of the body plays a major role, the prism shape helps increase the lift and glide, the body is accompanied with a detachable surface wing structures, which is pulled from the body, across the front horizontal stabilizer and back one to maintain control and lift. To be noted that, the twin stabilizers are not retracted until the approach phase begins, and are accompanied by a landing grapple on the other vertex to maintain the symmetry and the center of gravity, this is part of design A, and the following alternative designs B and C are similar yet have different wing configuration. The vertex faces are run through computational simulations to measure the thermal stress and load, especially during high velocity and atmospheric phases of flight, also to measure the net structural strength, these values are referenced in terms of materials commonly used for the construction of the stage. The trajectory for the approach is simulated considering the safety and precision of landing, since it has no chance for a go-around and abort it is quite similar to the space shuttle landing The goal here is to study the characteristics of using this specific design and a few other designs to estimate the efficiency of landing the rockets instead of retro propulsion or catching it for complete reusability and reliability. The results indicate that the massive stress experienced by the vertices exists but it exists slightly below the limitations, which is quite important during critical phases of flight such as Max Q, the data is produced in contrast to a sample launch vehicle, further landing efficiency tests data are yet to be analyzed to understand whether such system of landing is effective or worth physical testing.