

Effect of Wavy Leading-Edges on Wings in Different Planetary Atmospheres

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Abstract : Today we are unmarking the secrets of the universe by exploring different stars and planets and most of the space exploration is done by unmanned space robots. In addition to our planet Earth, there are pieces of evidence that show other astronomical objects in our solar system such as Venus, Mars, Saturn's moon Titan and Uranus support the flight of fixed wing air vehicles. In this paper, we take forward the concept of presence of large rounded tubercles along the leading edge of a wing and use it as a passive flow control device that will help in improving its aerodynamic performance and maneuverability. Furthermore, in this research, aerodynamic measurements and performance analysis of wavy leading tubercles on the fixed wings at 5-degree angle of attack are carried out after determination of the flow conditions on the selected planetary bodies. Wavelength and amplitude for the sinusoidal modifications on the leading edge are analyzed and simulations are carried out for three-dimensional NACA 0012 airfoil maintaining unity AR (Aspect Ratio). Tubercles have consistently demonstrated the ability to delay and decrease the severity of stall as per the studies were done in the Earth's atmosphere. Implementing the same design on the leading edges of Micro-Air Vehicles (MAVs) and UAVs could make these aircrafts more stable over a greater range of angles of attack in different planetary environments of our solar system.

Keywords : amplitude, NACA0012, tubercles, unmanned space robots

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