World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:14, No:03, 2020

Dynamic Stall Characterization of Low Reynolds Airfoil in Mars and Titan's Atmosphere

Authors : Vatasta Koul, Vaibhav Sharma, Ayush Gupta, Rajesh Yadav

Abstract : Exploratory missions to Mars and Titan have increased recently with various endeavors to find an alternate home to humankind. The use of surface rovers has its limitations due to rugged and uneven surfaces of these planetary bodies. The use of aerial robots requires the complete aerodynamic characterization of these vehicles in the atmospheric conditions of these planetary bodies. The dynamic stall phenomenon is extremely important for rotary wings performance under low Reynolds number that can be encountered in Martian and Titan’s atmosphere. The current research focuses on the aerodynamic characterization and exploration of the dynamic stall phenomenon of two different airfoils viz. E387 and Selig-Donovan7003 in Martian and Titan’s atmosphere at low Reynolds numbers of 10000 and 50000. The two-dimensional numerical simulations are conducted using commercially available finite volume solver with multi-species non-reacting mixture of gases as the working fluid. The k-epsilon (k-ε) turbulence model is used to capture the unsteady flow separation and the effect of turbulence. The dynamic characteristics are studied at a fixed different constant rotational extreme of angles of attack. This study of airfoils at different low Reynolds number and atmospheric conditions on Mars and Titan will be resulting in defining the aerodynamic characteristics of these airfoils for unmanned aerial missions for outer space exploration.

Keywords : aerodynamics, dynamic stall, E387, SD7003
Conference Title : ICAAE 2020 : International Conference on Aeronautics and Aerospace Engineering
Conference Location : Tokyo, Japan
Conference Dates : March 23-24, 2020