عنوان مقاله:

Computational Fluid Dynamic Analysis of Amphibious Unmanned Aerial Vehicle

محل انتشار:

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خلاصه مقاله:

Unmanned Aerial Vehicles (UAVs) are becoming popular due to its versatile maneuvering and high pay load carrying capabilities. Military, navy and coastal guard makes crucial use of the amphibious UAVs which includes the working functionalities of both hover craft and multi-rotor systems. Inculcation of these two systems and make it as amphibious UAV for water quality monitoring, sampling and analysis is essential to serve the human-kind for providing clean water. On this note, an amphibious UAV is designed for carrying a water sampler mechanism with an on-board sensor unit. In order to examine the stability of designed UAV under diverse wind load conditions and to examine the aerodynamic performance characteristics, computational fluid dynamic analysis (CFD) is performed. For various flight conditions such as pitch, roll, yaw and hovering, the flow characteristics around the vehicle body is examined. The aerodynamic phenomenon at the rotor section, vortex, turbulent regions, wake and tip vortex are identified. In addition, CFD analysis are conducted to determine the thrust forces during forward and hovering conditions through varying the wind speed ۳ to ۱۰ m/sec and speed of rotor ۲۰۰۰ to ۵۰۰۰ rpm. The effect of non-dimensional parameters such as advance ratio and induced inflow ratio on estimating the thrust characteristics are studied. Simulation results suggested that at ۵° angle of attack and ۸ m/sec wind speed condition, the aerodynamic performance of the vehicle is superior and stable flight is guaranteed. The amphibious UAV with flying and gliding modes for collecting water samples in remote water bodies and also in-situ water quality measurement can be well utilized for water quality monitoring.

کلمات کلیدی:
RANS Model, Amphibious vehicle, multi rotor interaction, CFD