World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:12, No:01, 2018

Study of Efficiency of Flying Animal Using Computational Simulation

Authors : Ratih Julistina, M. Agoes Moelyadi

Abstract : Innovation in aviation technology evolved rapidly by time to time for acquiring the most favorable value of utilization and is usually denoted by efficiency parameter. Nature always become part of inspiration, and for this sector, many researchers focused on studying the behavior of flying animal to comprehend the fundamental, one of them is birds. Experimental testing has already conducted by several researches to seek and calculate the efficiency by putting the object in wind tunnel. Hence, computational simulation is needed to conform the result and give more visualization which is based on Reynold Averaged Navier-Stokes equation solution for unsteady case in time-dependent viscous flow. By creating model from simplification of the real bird as a rigid body, those are Hawk which has low aspect ratio and Swift with high aspect ratio, subsequently generating the multi grid structured mesh to capture and calculate the aerodynamic behavior and characteristics. Mimicking the motion of downstroke and upstroke of bird flight which produced both lift and thrust, the sinusoidal function is used. Simulation is carried out for varied of flapping frequencies within upper and lower range of actual each bird's frequency which are 1 Hz, 2.87 Hz, 5 Hz for Hawk and 5 Hz, 8.9 Hz, 13 Hz for Swift to investigate the dependency of frequency effecting the efficiency of aerodynamic characteristics production. Also, by comparing the result in different condition flights with the morphology of each bird. Simulation has shown that higher flapping frequency is used then greater aerodynamic coefficient is obtained, on other hand, efficiency on thrust production is not the same. The result is analyzed from velocity and pressure contours, mesh movement as to see the behavior.

Keywords : characteristics of aerodynamic, efficiency, flapping frequency, flapping wing, unsteady simulation
Conference Title : ICAAA 2018 : International Conference on Applied Aerodynamics and Aeromechanics
Conference Location : London, United Kingdom
Conference Dates : January 18-19, 2018