

Numerical and Experimental Analyses on Aerodynamic Characteristic and Aeroacoustic Noise of Propeller for UAV

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Abstract: An UAV is an unmanned aerial vehicle, commonly known as a drone and referred to as a remotely piloted aircraft without a human pilot aboard. The UAV is not only deployed for military and special operation applications, but also used in a small growing number of civil applications such as policing and firefighting, and nonmilitary security work such as surveillance of pipelines. Facebook and Google have bought drone manufacturers this year to bring internet connectivity to remote parts of the world using drones instead of satellites as telecom relays. Amazon also made headlines last Christmas by announcing that it aimed to begin delivered by drone within five years.

The present study focuses on the aerodynamic characteristic and aeroacoustic noise of the propeller used for UAV. The propeller includes 3-blades with 9 inch diameter. The objective of the present study is to develop the blade profile satisfying the thrust force of 1.6 kg and the overall noise of 60 dB(A) 10 m away from UAV. For CFD (Computational Fluid Dynamics) simulation, a computational domain is considered for a repeating section of single blade, and periodic boundary conditions are adopted. To validate the numerical method, the experiment is performed. In addition, the effect of blade pitch on the propeller performance is analyzed, and the optimal value of the blade pitch is obtained. Through the numerical and experimental results, we would like to present not only the aerodynamic and aeroacoustic characteristics of 3-blade propeller but also the optimal design of blade profile used for UAV.