Journal of Aeronautics & Aerospace Engineering
ISSN: 2168-9792
OPEN ACCESS Freely available online
Perspective

Aerodynamic Performance and the Future of Electric Vertical Takeoff and Landing (eVTOL) Technology

Noo Li Jeon*

Electroceramics Group, Department of Materials Science and Engineering, Shiraz University of Technology, Shiraz, Iran

DESCRIPTION

Urban populations have seen rapid growth in recent years, resulting in increased traffic congestion caused by private cars. To mitigate this problem, Urban Air Mobility (UAM) has gained worldwide attention as a solution. This includes air taxi services that utilize existing aircraft like light jets and helicopters, and the development of next-generation Electric Vertical Takeoff and Landing Vehicles (eVTOL) which offer environmentally friendly personal air travel.

However, the development of eVTOL technology is challenging due to the extensive testing required to verify flight safety, which increases both development time and cost. To address this issue, researchers are investigating aerodynamic performance as a key component of eVTOL technology. This includes experiments using particle image velocimetry and wind tunnel tests to measure lift and drag forces, and visualize the flow field around a rotating rotor.

Electric Vertical Takeoff and Landing (eVTOL) technology refers to a type of aviation that utilizes electric propulsion to take off, hover, and land vertically. It is seen as a promising solution to the issue of traffic congestion in urban areas, as it provides a more environmentally friendly mode of transportation for personal air travel. The eVTOL vehicles can take the form of air taxis that use existing aircraft such as light jets and helicopters, or as the next generation of Urban Air Mobility (UAM) vehicles.

Despite its potential, the development of eVTOL technology has been slow and costly due to the need for extensive testing to verify flight safety. This has led to a focus on aerodynamic performance, which is a crucial component of eVTOL technology. Researchers have used wind tunnel tests and particle image velocimetry to measure lift and drag forces and visualize the flow field around rotating rotors. In addition, numerical simulations have been utilized to investigate the aerodynamic interaction of coaxial propellers.

To better understand the aerodynamic interaction of coaxial propellers, numerical simulations have been employed. These simulations model the propeller lift or compute the actual propeller rotation. However, these simulations are limited in that they only consider the steady state and do not take into account the body movement. This highlights the need for more advanced simulation techniques to reduce the number of actual flight tests required in the development process.

To achieve this, a simulation technique that combines multiple factors is required, including the ability to simulate unsteady flow caused by flight and aerodynamic effects on the aircraft. A moving grid method and simulation of fluid and rigid-body dynamics have been developed to simulate a wide range of aircraft behavior, including takeoff, landing, cruising, and crashing, as well as transitions between these flight phases. This reduction in the number of experiments and prototypes has several benefits, including reduced development time and cost.

The current study aims to investigate the aerodynamic effect and behavior in response to propeller rotation and body movement using the moving grid method. To simulate basic flight behavior, a coaxial propeller aircraft model is used, as it offers compactness and safety in the event of propeller trouble. The Moving Computational Domain (MCD) method is employed based on the Moving-Grid Finite Volume (MGFV) method, which enables the grid to move freely in three-dimensional (3D) space. The multi-axis sliding mesh method, which uses arbitrary boundary planes to divide and move a portion of computational domains, is also introduced. This allows for direct calculation of propeller rotation and aircraft movement, and the incorporation of Proportional-Differential (PD) control into the computational program enables automatic adjustment of propeller speed by providing only the target aircraft status, such as altitude, speed, and attitude.

In conclusion, eVTOL flight can be computationally simulated using flight simulation methods that take into account fluid-rigid body interactions. The development of advanced simulation techniques that can reduce the number of actual flight tests is crucial to the efficient development of eVTOL technology. By simulating basic flight behavior, including takeoff and horizontal rotation, researchers can better understand the aerodynamic performance of eVTOLs and make improvements to increase efficiency and safety.

Correspondence to: Noo Li Jeon, Electroceramics Group, Department of Materials Science and Engineering, Shiraz University of Technology, Shiraz, Iran; E-mail: jeon123@gmail.com

Received: 08-Jul-2022, Manuscript No. JAAE-22-21614; **Editor assigned:** 11-Jul-2022, PreQC No: JAAE-22-21614 (PQ); **Reviewed:** 27-Jul-2022, QC No: JAAE-22-21614; **Revised:** 02-Aug-2022, Manuscript No: JAAE-22-21614 (R); **Published:** 09-Aug-2022. DOI: 10.35248/2168-9792.22.11.290.

Citation: Jeon NL (2022) Aerodynamic Performance and the Future of Electric Vertical Takeoff and Landing (eVTOL) Technology. J Aeronaut Aerospace Eng. 11: 290.