

## Aerodynamic Design and Optimization of Vertical Take-Off and Landing Type Unmanned Aerial Vehicles

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**Abstract :** The airplane history started with the Wright brothers' aircraft and improved day by day. With the help of this advancements, big aircrafts replace with small and unmanned air vehicles, so in this study we design this type of air vehicles. First of all, aircrafts mainly divided into two main parts in our day as a rotary and fixed wing aircrafts. The fixed wing aircraft generally use for transport, cargo, military and etc. The rotary wing aircrafts use for same area but there are some superiorities from each other. The rotary wing aircraft can take off vertically from the ground, and it can use restricted area. On the other hand, rotary wing aircrafts generally can fly lower range than fixed wing aircraft. There are one kind of aircraft consist of this two types specifications. It is named as VTOL (vertical take-off and landing) type aircraft. VTOLs are able to takeoff and land vertically and fly horizontally. The VTOL aircrafts generally can fly higher range from the rotary wings but can fly lower range from the fixed wing aircraft but it gives beneficial range between them. There are many other advantages of VTOL aircraft from the rotary and fixed wing aircraft. Because of that, VTOLs began to use for generally military, cargo, search, rescue and mapping areas. Within this framework, this study answers the question that how can we design VTOL as a small unmanned aircraft systems for search and rescue application for benefiting the advantages of fixed wing and rotary wing aircrafts by eliminating the disadvantages of them. To answer that question and design VTOL aircraft, multidisciplinary design optimizations (MDO), some theoretical terminologies, formulations, simulations and modelling systems based on CFD (Computational Fluid Dynamics) is used in same time as design methodology to determine design parameters and steps. As a conclusion, based on tests and simulations depend on design steps, suggestions on how the VTOL aircraft designed and advantages, disadvantages, and observations for design parameters are listed, then VTOL is designed and presented with the design parameters, advantages, and usage areas.

**Keywords :** airplane, rotary, fixed, VTOL, CFD

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