

Characteristics and Flight Test Analysis of a Fixed-Wing UAV with Hover Capability

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Abstract : In this study, characteristics and flight test analysis of a fixed-wing unmanned aerial vehicle (UAV) with hover capability is analyzed. The base platform is chosen as a conventional airplane with throttle, ailerons, elevator and rudder control surfaces, that inherently allows level flight. Then this aircraft is mechanically modified by the integration of vertical propellers as in multi rotors in order to provide hover capability. The aircraft is modeled using basic aerodynamical principles and linear models are constructed utilizing small perturbation theory for trim conditions. Flight characteristics are analyzed by benefiting from linear control theory's state space approach. Distinctive features of the aircraft are discussed based on analysis results with comparison to conventional aircraft platform types. A hybrid control system is proposed in order to reveal unique flight characteristics. The main approach includes design of different controllers for different modes of operation and a hand-over logic that makes flight in an enlarged flight envelope viable. Simulation tests are performed on mathematical models that verify asserted algorithms. Flight tests conducted in real world revealed the applicability of the proposed methods in exploiting fixed-wing and rotary wing characteristics of the aircraft, which provide agility, survivability and functionality.

Keywords : flight test, flight characteristics, hybrid aircraft, unmanned aerial vehicle

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