

VTOL-Fw Mode-Transitioning UAV Design and Analysis

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Abstract : In this study, an unmanned aerial vehicle (UAV) with level flight, vertical take-off and landing (VTOL) and mode-transitioning capability is designed and analyzed. The platform design combines both multirotor and fixed-wing (FW) conventional airplane structures and control surfaces; therefore named as VTOL-FW. The aircraft is modeled using aerodynamical principles and linear models are constructed utilizing small perturbation theory for trim conditions. The proposed method of control includes implementation of multirotor and airplane mode controllers and design of an algorithm to transition between modes in achieving smooth switching maneuvers between VTOL and FW flight. Thus, VTOL-FW UAV's flight characteristics are expected to be improved by enlarging operational flight envelope through enabling mode-transitioning, agile maneuvers and increasing survivability. Experiments conducted in simulation and real world environments shows that VTOL-FW UAV has both multirotor and airplane characteristics with extra benefits in an enlarged flight envelope.

Keywords : aircraft design, linear analysis, mode transitioning control, UAV

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