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Modeling and Optimal Control of Hybrid Unmanned Aerial Vehicles with Wind Disturbance

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Abstract : This paper addresses modeling and control of a six-degree-of-freedom unmanned aerial vehicle capable of vertical take-off and landing in the presence of wind disturbances. We design a hybrid vehicle that combines the benefits of both the fixed-wing and the rotary-wing UAVs. A non-linear model for the hybrid vehicle is rapidly built, combining rigid body dynamics, aerodynamics of wing, and dynamics of the motor and propeller. Further, we design a H_2 optimal controller to make the UAV robust to wind disturbances. We compare its results against that of proportional-integral-derivative and linear-quadratic regulator based control. Our proposed controller results in better performance in terms of root mean squared errors and time responses during two scenarios: hover and level- flight.

Keywords : hybrid UAVs, VTOL, aircraft modeling, H2 optimal control, wind disturbances
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