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Thesis: **"Design and development of a UAV with hybrid flight capabilities for electrical tower inspection"**

Summary:

The stability and control of unmanned aerial vehicles (UAVs) are a continuous case study in applied automatic control. Nowadays the flight control of common UAVs like multi-rotor and fixed-wing aircraft is widely studied, and there is extended research in different methods to perform better performance in the control of such vehicles. The actual case study consists of developing and implementing new control algorithms for the relatively new UAV prototypes that can perform both flight modes (hover and cruise), these new aircraft are called hybrid flight mode UAVs. Some of these prototypes are the tilt-rotor, the converti-plane UAV, the tilt wing UAV, and the tailsitter UAV. This last hybrid UAV consists of a fixed structure mainly composed of a wing which is responsible for generating the aerodynamic forces during the cruise flight mode. Due to the fixed structure of the tail-sitter UAV, the changing between the flight modes relies on the rotation of the whole UAV body from vertical (nose pointing upward) for the hover mode, to horizontal alignment (nose pointing forward) for the cruise flight mode. This way, the transition and the flight control of this hybrid-type UAV represent a study area for automatic control.

In this document, we are going to investigate the flight control and stability of the tail-sitter UAV especially focused during the hover mode due to the fact that, during this flight mode the wing is oriented vertically, and external wing gusts extremely affect the aerodynamics of the aircraft causing undesired disturbances and instability. To mitigate these external and non desired forces, we will propose a state and disturbance observer which will help the main flight control to stabilize the position and attitude of the UAV. Also, this document presents other similar cases assessing an adaptive control for a fully actuated UAV in the instance where some aircraft parameters are unknown. Later, we slightly explain a possible application of the tailsitter UAV consisting of a tower inspection through neural networks and automatic navigation. And finally, the process of design and construction of the proposed UAV xiii prototype is presented describing the material, electrical components, and the flight test results obtained. xiv