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Trustable UAV for Higher Level Control Architectures

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Abstract – Future unmanned air vehicles (UAVs) are expected to operate under the supervision of higher level control architectures that give instructions to engage and direct the UAV to perform a certain task. These instructions allow the UAV to make decisions along any point of its trajectory and then modify its flight path by using a sequence of reconfigurable controllers at the decision points. Assume that the UAV is flying with a transient and with a steady state contributing to a flight control mode (FCM) such as an altitude hold, an ascent and a descent mode when only longitudinal aircraft dynamics is considered. At the time of a decision, if the UAV bifurcates from its original (or parent) FCM in an effort to acquire a new (or a child) FCM and comply with a higher level instruction, then the UAV is said to be trustable. Mathematically, at the time of bifurcation where controller reconfiguration takes place, trustable UAV with the child trajectory must originate from a region where the stability regions of the parent and child trajectories intersect. In this paper, a procedure to reconfigure such FCMs and their controllers that develop the trustable UAV are presented. A three degree of freedom UAV is considered to illustrate the trustable UAV.

Keywords: Flight control modes, UAVs, transients, steady states, higher level instructions, switching, stability.

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