ROBUST CONSENSUS FOR SWARM OF UAVS

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Abstract

Cooperation control strategy for a swarm of UAVs is an important problem and an area of active research. Cooperation control strategy for a swarm of UAVs is based on the collective biological behavior of agents and their individual behavior to achieve the collective goal. Consensus in Multi Agent System (MAS) acts as building block for various cooperation methodologies like rendezvous, formation control, alignment, swarming, and flocking. Consensus control of MAS depends on the globally selected state of the agents in the system in order to come to a common conclusion to achieve the desired task. This globally selected state can be position, velocity, and acceleration of the individual UAV in the MAS. All agents share their relative information about this globally selected state with each other. In this study a linear time invariant MAS model is considered and a fixed topology swarm of UAVs is interpreted as the undirected graph network, with each UAV acting as a node in the graph. A control law is designed ensuring error convergence. An observer based controller design is proposed to address the issue of requirement of multiple sensors for the full state information needed for error convergence. Further, estimation of disturbance is obtained using an Uncertainty and Disturbance Estimator (UDE) to achieve robust consensus in the presence of disturbances. It is found that this strategy of controlling swarm of UAVs is efficient in achieving consensus of MAS even in the presence of external disturbance. And thereby offering the viable solution to the practical problems where the human exhibits limited capabilities.

Keywords: Consensus; UAV; Swarm; Disturbance estimation; State estimation