

Network Measures and Adaptive Topology

We investigate network measures to quantify the effectiveness of the control interfaces with the network, and in particular the average quadratic performance cost (the mean tracking measure) and the open loop \mathcal{H}_2 norm (the variance damping measure) of the network dynamics. In fact, when the network dynamics is diffusive, both measures provide a means of relating topological features of the interaction network which promote manageability of the swarm.

In situations where the interaction network topology is particularly unsuitable for effective control interfaces, an option is to redesign the network online - where this is possible, for example via the wireless nature of the interactions. In particular, the open loop \mathcal{H}_2 norm for the network can be employed to dynamically rewire the interaction network topology improving the effectiveness of the controllers' interface with the network.

[pictorialSummary.png](#)

Publications:

- Airlie Chapman, Eric Schoof and Mehran Mesbahi (2013) "Distributed Online Topology Design for Disturbance Rejection". In Proc. of the IEEE Conference on Decision and Control. (accepted)
- Airlie Chapman and Mehran Mesbahi (2013) [Semi-Autonomous Consensus: Network Measures and Adaptive Trees](#), 19-31. In IEEE Transactions on Automatic Control 58 (1).
- Airlie Chapman and Mehran Mesbahi (2012) [System Theoretic Aspects of Influenced Consensus: Single Input Case](#), 1505-1511. In IEEE Transactions on Automatic Control 57 (6).
- Airlie Chapman and Mehran Mesbahi (2010) [Semi-Autonomous Networks: Network Resilience and Adaptive Trees](#), 7473-7478. In Proc. of the IEEE Conference on Decision and Control. (Invited Paper) [Slides](#)
- Airlie Chapman, Eric Schoof and Mehran Mesbahi (2010) [Semi-Autonomous Networks: Theory and Decentralized Protocols](#), 1958-1963. In Proc. of the IEEE International Conference on Robotics and Automation. [Slides](#)
- Airlie Chapman, Marzieh Nabi-Abdolyousefi and Mehran Mesbahi (2009) [Identification and Infiltration in Consensus-type Networks](#), 84-89. In 1st IFAC Workshop on Estimation and Control of Networked Systems. (Finalist for the best student paper award) [Poster](#)

UAV Swarming with Wind Gusts

Dynamic network redesign provides an approach to improve the effectiveness of the human controllers' signal in reducing a wind gust perturbing the UAV swarm. Specifically by rewiring the interaction network topology, we are able to amplify the human controllers' signal, to more effectively dampen the perturbation.

thumb.png

Publications:

- Airlie Chapman and Mehran Mesbahi (2013) "UAV Swarms: Models and Effective Interfaces". In Handbook of Unmanned Aerial Vehicles, Springer. (to appear)
- Airlie Chapman, Ran Dai and Mehran Mesbahi (2011) [Network Topology Design for UAV Flocking with Wind Gusts](#). In Proc. of the AIAA Guidance, Navigation and Control Conference. [Slides](#)
- Airlie Chapman and Mehran Mesbahi (2011) [UAV Flocking with Wind Gusts: Adaptive Topology and Model Reduction](#), 1045-1050. In Proc. of the American Control Conference. (Best session presentation award) [Slides](#)