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 $H_2$ 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 manageableability 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 $H_2$ norm for the network can be employed to dynamically rewire the interaction network topology improving the effectiveness of the controllers' interface with the network.

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)
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.

Publications: