Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Modeling Passive Drag-Based Fish Interactions and their Relation to Formation Behaviors ABDALRAHMAN MANSY, IMRAAN FARUQUE, Oklahoma State University — Recent work coupled high speed imagery-based fish schooling measurements with computational fluid dynamics to provide estimates of the fish's thrust and drag forces. Reconfigurations indicating reductions in body drag during periods with minimal changes in kinematic inputs suggest that passive drag-based mechanisms could play a role in school reconfiguration and reduce the on-board sensory feedback demands. We use simplified interaction models to study the effects of passive drag-based interaction mechanisms in biological formations. Incompressible hydrodynamic forces were modeled as 1-D incompressible functions of egomotion, position, and velocity. We find conditions for relative position stability within the formation and compare two cases: (a) egomotion and relative position sensitivity only, and (b) egomotion, relative position, and relative velocity. Model (a) shows the agents' relative positions are dynamically unstable theoretically and in simulation, while (b) is dynamically stable. This finding suggests that mechanisms to reconfigure individuals to lower drag states require relative velocity sensitivity, either through fluid interaction functions or active sensory feedback.

Abdalrahman Mansy
Oklahoma State University

Date submitted: 01 Aug 2019 Electronic form version 1.4