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Collective Motion in Animals Groups from an Idealized Perspective

The collective motion of groups of animals often exhibits interesting patterns, both visually and mathematically. Common examples include schooling fishes and flocking birds. Often, individuals in such a group can only communicate locally (i.e., with nearest neighbours), yet the aggregate exhibits some global pattern. With such biological groups as motivation, an interacting self-propelled particle ODE model is used to study some idealized 'perfect school' formations. The regular geometry of such formations allows analytical insights on existence and stability that are not typically possible from numerical simulation alone. This approach allows one to make concrete connections between properties of individuals, and properties of the emergent pattern at the group level.

Although there has been quite a few modeling studies of such animal groups, there has been relatively little real data for comparison, typically owing to the difficulty of obtaining such data reliably. In this talk, I will discuss our modeling approach and results, and also briefly discuss some efforts in collecting field data on groups of aquatic diving ducks.